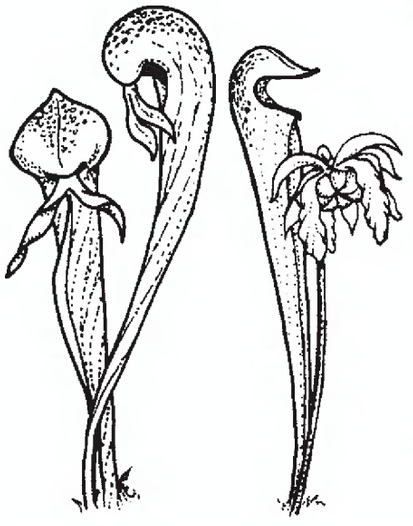
CARNIVOROUS PLANT NEWSLETTER

Journal of the International Carnivorous Plant Society

Volume 52, No. 2 June 2023



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Journal of the International Carnivorous Plant Society
www.carnivorousplants.org

Volume 52, Number 2
June 2023

Front Cover: The Cuban endemic, *Pinguicula lithophytica*, is found only in a small part of the Escambray (or Trinidad) Mountains, where it generally grows on vertical calcareous rock. Photo by Ivan Pančo. Article on page 68.

Back Cover: Flowers of the Cuban endemics, *Pinguicula jackii*, *P. lithophytica*, and *P. jaraguana*, (clockwise from top), showing relative sizes and other characteristics for comparison, in particular their spurs. Composite photo by Ivan Pančo. Article on page 68.

Carnivorous Plant Newsletter is dedicated to spreading knowledge and news related to carnivorous plants. Reader contributions are essential for this mission to be successful. Do not hesitate to contact the editors with information about your plants, conservation projects, field trips, or noteworthy events. Advertisers should contact the editors. Views expressed in this publication are those of the authors, not the editorial staff.

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Date of effective publication of the March 2023 issue of Carnivorous Plant Newsletter: February 7, 2023.

The ICPS is the International Cultivar Registration Authority (ICRA) for the names of cultivated carnivorous plants according to the International Code of Nomenclature for Cultivated Plants. Send relevant correspondence to the ICPS, Inc.

Carnivorous Plant Newsletter is published quarterly in March, June, September, and December by the ICPS, Inc., 2121 N. California Blvd., Suite 290, Walnut Creek, CA 94596, USA. Periodicals postage paid at Walnut Creek, CA and additional mailing offices. Postmaster: Send address changes to ICPS, Inc., 2121 N. California Blvd., Suite 290, Walnut Creek, CA 94596, USA. Printed by Sheridan, 810 E. 10th Street, Lawrence, KS 66044. Logo and masthead art: Paul Milauskas.
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Support the ICPS Conservation Fund

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https://doi.org/10.55360/cpn522.ct522

Conservation organizations like The Nature Conservancy (TNC) and research institutions like Auburn University do work for plants in the wild that has become essential in what is becoming "an age of extinction". The ICPS is proud to support and honor such work.

This year, the ICPS is sponsoring new and important protections and site maintenance that *Sarracenia* urgently require in the United States. ICPS conservation donations have funded The Nature Conservancy's wish to install new, up-to-date protective elements for at-risk locations home to the CITES-I endangered species in Alabama. The ICPS also now sponsors site maintenance for those species with TNC and Auburn University. We are very proud to support TNC maintenance of the famous Splinter Hill bog complex and Pensacola Rainwater Preserve. These sites are home to some of the last great *Sarracenia* fields left on earth, including a veritable sea of *S. leucophylla*, and the extremely local *S. alabamensis* subsp. *wherryi.*

It does not take much money to protect these plants, but all too often such protections do not make the priority list. It is my sincere request that you consider donating to our cause.

Pinguicula lithophytica is not conspecific with *Pinguicula jaraguana* or a variety of *Pinguicula jackii*

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Keywords: butterwort, carnivorous plant, Central-Eastern Plain, Cuba, Escambray Mountain Range, Guamuahaya Massif, Lentibulariaceae, Sagua-Baracoa Massif.
Received: 16 February 2023
https://doi.org/10.55360/cpn522.pt301

Abstract: The taxonomic status of *Pinguicula lithophytica* had been challenged both in publications and in discussions. It was proposed that *P. lithophytica* is conspecific with *Pinguicula jaraguana*. Both taxa represent Cuban endemics but they are from widely separate locations. Comparison with *P. jaraguana* was not considered by Panfet Valdés and Temple as the taxon was unknown to the authors; subsequent awareness did not cause the authors to question their original decision that assigned species status to *P. lithophytica* that some individuals later perceived demonstrated no significant differences to *P. jaraguana*. Recently published and even more recent unpublished information concerning *P. jaraguana* has allowed comparison with previously unpublished information about *P. lithophytica*. Comparison of the morphology of both species, especially of newly described seeds and new or enhanced measurement of leaf length and width and flower characteristics reveals sufficient differences to attest to their being separate taxa. The name *Pinguicula lithophytica* was also presented as synonymous with *P. jackii* var. *parviflora* but this is rejected as the latter name has no valid publication.

Introduction

Since the original descriptions of *Pinguicula albida* C.Wright ex Griseb. and *Pinguicula filifolia* C.Wright ex Griseb. (Grisebach 1866, p. 162), the *Pinguicula* of Cuba received little attention beyond their initial identification until León & Alain (1957) described and keyed all of the then known five species (*P. albida* C.Wright ex Griseb., *P. benedicta* Barnhart, *P. filifolia* C.Wright ex Griseb., *P. jackii* Barnhart, and *P. lignicola* Barnhart). Ernst (1961) revised 35 then globally known taxa within genus *Pinguicula* that then included only five Cuban taxa. This was soon followed by a revision of the genus, then numbering as many as 53 taxa (including natural hybrids and *nomina dubia*), by Casper (1966) still with only five recognised Cuban taxa included. The next review of the now much enlarged genus, with 91 recognised species (excluding sub-taxa) was conducted 50 years later, in two volumes (Lampard *et al*. 2016; Roccia *et al*. 2016), and this recognised nine Cuban taxa. There followed a review of the numerous and mostly recently discovered *Pinguicula* of Cuba (Casper 2019) in which 14 species and one subspecies were recognised, excluding *P. benedicta* that was mentioned as a puzzling "dubious taxon". Throughout this period, numerous individual papers were published to announce newly discovered species,

notably by Casper but other authors also made contributions. Although the descriptions of new species made some comparisons of related taxa, this was often hampered by the absence of sufficient material, especially observations of living specimens. In addition, key characteristics used for descriptions of new taxa often varied, resulting in an inability to compare characteristics across two or more taxa.

By 2013, the aforementioned two-volume work (Lampard *et al*. 2016; Roccia *et al*. 2016) had begun to attempt to document all known *Pinguicula* taxa (many new species had been discovered since any previous publication describing the genus). As the work progressed, significant disagreement arose with regard to some taxa, in part resulting in *P. lithophytica* being considered conspecific with *P. jaraguana*, as a consequence necessitating that the species description be completed by combining the characteristics of both original taxa. The ongoing absence of an agreement was indicated by inclusion within the description that "future studies may well demonstrate that the separation of the two at subspecies or species rank is merited" (Lampard *et al*. 2016: p. 558, 560). As a result, the identities of the original *P. lithophytica* (Panfet-Valdés & Temple 2008) and *P. jaraguana* (Casper 2003) were blurred, creating a need to confirm or resolve their identities by extending knowledge of their characteristics, especially for *P. jaraguana* that had many morphological features that were entirely unknown or described without accompanying supporting evidence. Later, Casper (2019) declared no reservations with regard to the representation of *P. lithophytica* and *P. jaraguana* as accepted species and criticised their merger, emphasizing his acceptance of the legitimacy of two taxa with his statement:

The 'mystery' of the white-flowering '*Pinguicula jackii*' was solved when on 28 Feb 1995, C. Panfet-Valdés, P. Temple and J. Gutiérrez discovered plants that were later described as *P. lithophytica*.

Shortly after publication of the disputed conspecific taxonomic status of *Pinguicula lithophytica* with *P. jaraguana*, Shimai (2017: p. 292) represented the name *P. lithophytica* as synonymous of *P. jackii* Barnhart var. *parviflora* Alf.Ernst. No justification preceded or accompanied the declaration.

Our objective is to clarify the taxanomic status of *Pinguicula lithophytica* by comparing its morphology with the taxa it has been regarded as conspecific with and to clarify its nomenclatural status. To achieve this, we analysed and described the appropriate taxa in detail and considered their nomenclatural history.

Materials and methods

The three species were analysed based on new information and their protologues (Casper 2003; Panfet-Valdés & Temple 2008; and Barnhart 1931). To reduce too great a dependence on published data previously thought to represent *Pinguicula jaraguana* and *P. lithophytica*, measurements were taken from herbarium material of these taxa and used as data for a multivariate analysis. Seven quantitative variables were measured (Table 1) using Motic Image Plus 2.0^{ML} (Motic China Group Co., Ltd.) and the obtained data were tested for a normal distribution using Kolmogorov–Smirnov's test (KS) (Cox & Small 1978) with Lilliefors' significance correction (LSC) ($P = 0.000$). Principal Component Analysis (PCA) based on the correlation matrix was carried out by using PAST ver. 3.16 (Hammer *et al*. 2001) in order to reduce the number of quantitative variables and to obtain new axes that better explained the variation of data. The results were plotted in a two-dimensional graph defined by the new axes of the two first principal components (PCs). To standardize the approach, a like-for-like comparison of dried material was used; one leaf per plant was measured, in each case selecting that which appeared average for a particular specimen.

Table 1. Comparisons of selected characteristics of herbarium specimens of *Pinguicula jaraguana* and *P. lithophytica*. Measurements shown as minimum, average and maximum.

Ref.	Characteristic	*P. jaraguana*	*P. lithophytica*
LL	Leaf length	(1.00–)1.95(–2.70) cm	(4.30–)6.38(–7.50) cm
LW	Leaf width	(0.40–)0.84(–1.30) cm	(3.50–)4.49(–5.40) cm
CL	Corolla length with spur	(0.90–)1.30(–1.70) cm	(0.80–)1.10(–1.50) cm
ML	Corolla midlobe length	(0.60–)1.02(–1.30) cm	(0.60–)0.85(–1.00) cm
MW	Corolla midlobe width	(0.40–)0.58(–0.70) cm	(0.60–)0.82(–1.00) cm
SL	Spur length	(0.30–)0.46(–0.60) cm	(0.40–)0.53(–0.70) cm
SW	Spur width	(0.20–)0.26(–0.60) cm	(0.20–)0.38(–0.50) cm

All three taxa, *P. jaraguana*, *P. lithophytica*, and *P. jackii*, were studied using field observations (including photographs taken in the field), and from herbarium material (Appendix I). Fresh, mature seeds and capsules were examined and photographed with Canon PowerShot SX70 with Raynox Macroscopic Lens M-150 and Samsung Galaxy S10+ mobile phone. To measure seed dimensions, paper marked with a 1×1 mm. grid was used.

Taxonomic descriptions given by Casper (2019) for the three species were taken as a baseline. The descriptions were amended by applying both the measurements taken from herbarium material and the morphological evidence gained from observations of fresh material.

Descriptions of colours are notoriously difficult to accurately describe and are usually subjective. For example, *Pinguicula benedicta* flowers were first described as "blue" (Shafer 1910; Barnhart in Britton 1920) but, when compared with, *P. jackii* — the only other *Pinguicula* to be described as having a corolla that is blue (though without accompanying evidence) — the *P. benedicta* corolla colour can clearly be seen to be not a true blue, being closer to purple. The colour of any plant feature will vary over its entire surface. Therefore, colour descriptions are our subjective opinion of what best represents any overall surface colour.

The geographical distributions of *Pinguicula jaraguana* and *P. lithophytica* were compared so as to provide non-morphological factors as additional evidence to corroborate or reject earlier proposals of conspecificity. The density of east-Cuban *Pinguicula* species in habitat was arrived at by polygon mapping, using a 6×6 km^2 grid to calculate the smallest area that includes all mapped locations.

The claimed synonymity of the name *P. lithophytica* with *P. jackii* var. *parviflora* was assessed according to the International Code of Botanical Nomenclature (ICBN, Lanjouw *et al.* 1956) and the International Code of Nomenclature for algae, fungi, and plants (ICN; Turland *et al.* 2018).

Results and discussion

Results from analyses of herbarium material of *Pinguicula jaraguana* and *P. lithophytica* were compared (Table 1) and demonstrate clear differences, in particular when applied to a multivariate analysis (Fig. 1).

Morphological traits measured demonstrated clear differences between the two analysed taxa (Table 1) and PCA indicated two principal components (PCs) comprising 98.92% of total variance for the data (Fig. 1). In general, *Pinguicula jaraguana* has small leaves while those of *P. lithophytica* are larger, with no observed overlap of size ranges for length or width, suggesting these are

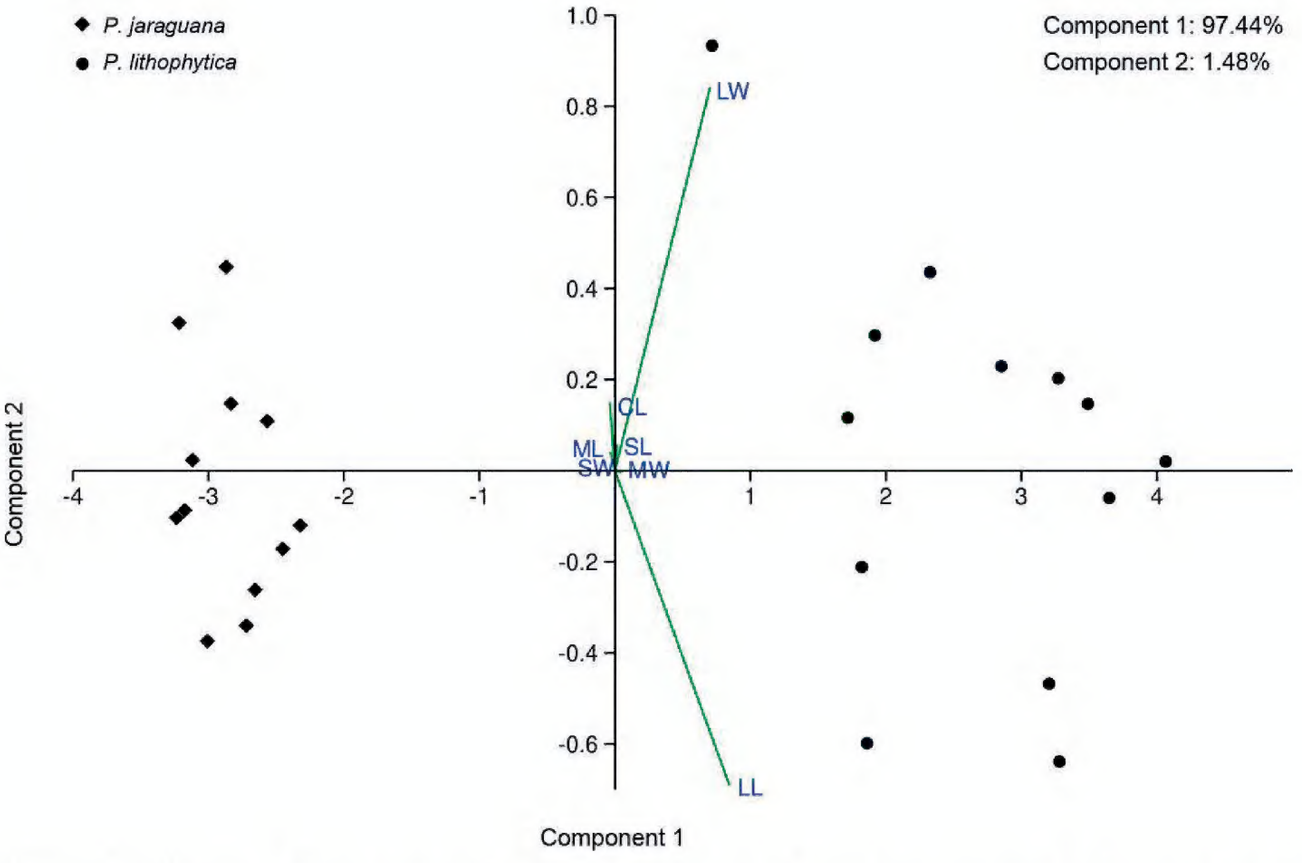

Figure 1: Principal Component Analysis based on selected morphometric characters of *Pinguicula jaraguana* and *P. lithophytica*.

defining characteristics separating the two species as pointed out for the genus by Zamudio Ruiz (2001). The corolla midlobes exhibited significant overlap in size at range extremes but otherwise are different, that of *P. jaraguana* being long and narrow whereas, in *P. lithophytica*, the midlobe is short and wide. The corolla length (without the spur) of *P. jaraguana* is longer than for *P. lithophytica* and this feature also separated the two species based on Component 2 (Fig. 1). This result clearly demonstrates that the multivariate analysis data reflects the presence of two distinct taxa, contradicting any suggestion of the two species being conspecific.

We propose redefinitions for *Pinguicula jaraguana* and *P. lithophytica*., based on those by Casper (2019) but including characteristics that are previously undescribed or which we modify as a result of our observations.

Pinguicula jaraguana Casper (Fig. 2–3, Back Cover)

Perennial herb, scapose, in a basal rosette, (19–)28–42(–60) mm in diameter; lying ± flat on the ground or somewhat erect, sometimes growing densely grouped together in colonies of many individuals. *Rhizome* short, with fibrous roots. *Leaves* (6–)9–12(–15), yellow-green, succulent, homophyllous, with carnivorous leaves exhibiting seasonally different shape and size (Fig. 3), (10–)19.5–20(–31.6) × (4–)8–8.4(–13) mm, oblong to spathulate, apex rounded, base narrowly cuneate into a short petiole, margins entire, involute; adaxial surface sparsely covered with glandular trichomes along the veins, the base with many-celled non-glandular trichomes; abaxial surface glabrous. *Scapes* 1(–4), 1-flowered, erect, (70–)110–150(–175) mm long, ± 0.55–0.60 mm thick, sparsely glandular with ± 15 stipitate and sessile trichomes/cm^2. *Flowers* white, indistinctly 2-lipped (subisolobate). *Calyx* yellow-green, distinctly 2-lipped shorter than the tube, ± 7 mm;

Figure 2: *Pinguicula jaraguana* in habitat.

outer surface sparsely covered with stalked glandular trichomes; upper-lip divided nearly to the base into 3 lobes, lobes oblong-obtuse, apex retuse, ± 3 × 1–1.5 mm; lower lip 2-lobed, the lobes free nearly from their bases. *Corolla* (12–)16–19(–22) mm long (including the spur), 22 mm diameter, widely opened, more or less rotate; the lobes recurved, with the tube at an angle of nearly 90°, broadly obovate, margins overlapping for half their length, 9–12 × 5–7 mm, much longer than the rest of the corolla (4–5 × longer than the tube), adaxial surface covered sparsely with non-glandular trichomes that are more abundant at the entrance to the tube; upper lip 2-lobed, lobes smaller than the two lateral lower-lip lobes; lower-lip deeply 3-lobed, lobes obovate, apex rounded, midlobe (6–)9–10.2(–13) × (4–)5.8–0.6(–7) mm. *Tube* very pale blue-white (almost white), deep purple-blue veins, cylindric, short, (2.5–)3–4(–5) × 1.5–2.5 mm, without palate; tripartite, the distal part short, narrow, densely covered with long, uniseriate capitate trichomes, the middle part with short multi–seriate capitate trichomes, the proximal part with long uniseriate simple trichomes. *Spur* white, deep purple-blue veins, very short, (3–)4.6(–6) × (2–)2.6(–6) mm, conical, rounded at the tip, strongly bent forming an acute angle with the tube. *Stamens* ± 1.5 mm long, the short filaments slightly curved; anthers ± 1 mm wide. *Pollen* stephano-4–5-colporate, prolate, surface punctitectate. *Ovary* subglobose-ovoid, sessile, ± 1.5 mm in diameter, 1-loculate, ending in a short style, glabrous. *Stigma* short, 2-lobed, the lower lobe broad, fringed, the upper lobe much smaller, narrowly oblong, fringed. *Capsule* globose, ± 3.5 × 3.5 mm. *Seeds* dark brown, fusiform, (0.43–)0.50–0.58(–0.65) × (0.13–)0.15–0.20 mm, testa reticulate, micropylar appendage prominent.

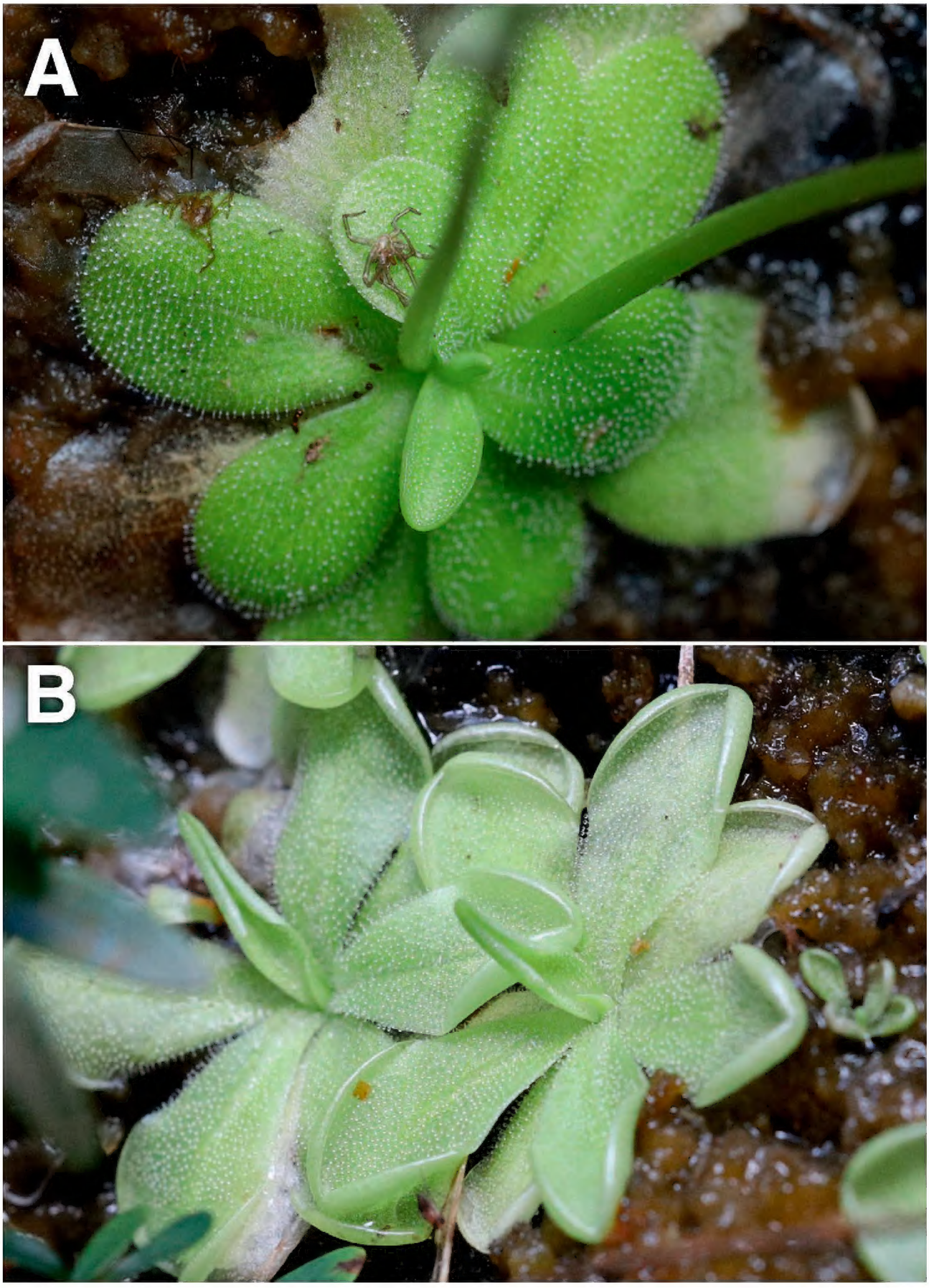

Figure 3: *Pinguicula jaraguana* summer rosette (A) and winter rosettes (B) in habitat.

Pinguicula lithophytica Panfet & P.Temple (Front Cover, Back Cover)

Perennial herb, scapose, in a basal rosette, (80–)100–126(–150) mm in diameter; lying ± flat on the ground, growing as isolated individuals. *Rhizome* short, with filiform roots. *Leaves* (5–)6–8(–12), green, succulent, homophyllous, with uniform carnivorous leaves all year round, (43–)50–63.8(–75) × (30–)35–44.9(–54) mm, obovate, apex rounded to obtuse, base cuneate, margins entire, slightly involute; adaxial surface densely covered with sessile and stipitate glandular trichomes, with many glandular trichomes; abaxial surface sparsely covered with stipitate glandular trichomes. *Scapes* 1– 3(–5), 1-flowered, erect, (80–)110–150(–180) mm long, ± 0.80 mm thick, intermediately glandular with ± 37 stipitate and sessile trichomes/cm^2. *Flowers* off-white (appearing white), yellow centre, sometimes with faint ± red-purple lobe margins, indistinctly 2-lipped (subisolobate). *Calyx* green, distinctly 2-lipped, shorter than the tube, ± 5 mm; outer surface covered with stipitate glandular trichomes; upper-lip divided nearly to the base into 3 lobes, lobes oblong, apex obtuse, ± 2 × 1–1.5 mm; lower lip 2-lobed, the lobes free nearly from their bases. *Corolla* (13–)14–18(–22) mm long (including the spur), ± 20–25 mm diameter, widely opened, almost bell-like; the lobes recurved, with the tube at an angle of more than 90°, orbicular to widely obovate, bases overlapping, 7–10 × 8–10 mm, nearly equally longer than the rest of the corolla, adaxial surface covered with stipitate glandular trichomes at the entrance of the tube; upper-lip 2-lobed, lobes a little smaller than the two lateral lower-lip lobes; lower-lip deeply 3-lobed, lobes nearly orbicular, apex obtuse to rounded, midlobe (6–)7–8(–9) × (6–)7–9(–10) mm. *Tube* yellow-green, dark yellow-brown veins, cylindric to subcylindric, (3–)4.2–5(–6) × (2–)3–3.5(–4) mm, without palate; tripartite, the distal part very short, expanded and bell-like, densely covered with long, uniseriate simple trichomes, the middle part densely covered with uniseriate simple trichomes mixed with capitate trichomes, the proximal part densely covered with uniseriate trichomes, mixed with uniseriate capitate trichomes. *Spur* yellow-green, dark yellow-brown veins, medium size, (4–)5.3(–7) × (2–)3.8(–5) mm, saccate, obtuse. *Stamens* ± 1.5 mm long, the filaments curved, flattened; anthers ± 1 mm wide. *Pollen* unknown. *Ovary* ovoid, sessile, ± 1.0 mm in diameter, 1-loculate, ending in a short style, moderately covered with stipitate glandular trichomes. *Stigma* short, 2-lobed, the lower lobe larger than the upper lobe, crenate. *Capsule* ovoid, ± 5 × 4 mm. *Seeds* dark brown, ellipsoid, 0.5 × 0.45–0.5 mm, testa verrucose, micropylar appendage prominent.

Pinguicula jackii Barnhart (Fig. 4, Back Cover)

Perennial herb, scapose, in a basal rosette, (50–)100–160(–200) mm diameter; lying ± flat on the ground, growing as isolated individuals. *Rhizome* short, with fibrous roots. *Leaves* (5–)7–10(–14), green, succulent, homophyllous, with uniform carnivorous leaves all year round, (21–)38.5–63.2(–100) × (17–)26–40(50) mm, obovate to ovate, apex rounded to obtuse, base narrowly cuneate, margin entire, slightly involute; adaxial surface densely covered with sessile glandular trichomes and scattered stipitate glandular trichomes, distinguished by a conspicuous bottle-like stalk cell, with many glandular trichomes; abaxial surface glabrous or with stipitate glandular trichomes sparsely covering the middle vein. *Scapes* 1–2(–5), 1-flowered, erect, (60–)83–108(–170) mm long, ± 0.80–0.85 mm thick, densely glandular with ± 58 stipitate and sessile trichomes/cm^2. *Flowers* purple-blue increasingly diffused with white toward the bases of the lobes, indistinctly 2-lipped (subisolobate). *Calyx* green, distinctly 2-lipped, shorter than the tube, ± 7 mm; outer surface glabrous or sparsely covered with stipitate glandular trichomes; upper-lip divided nearly to the base into 3 lobes, lobes oblong-obtuse, apex obtuse, ± 2.5 × 1–1.5 mm; lower-lip 2-lobed, the lobes free nearly from their bases. *Corolla* (22–)27–33(–40) mm long (including the spur), 28 mm diameter, widely opened, almost oblique bell-shaped; the lobes recurved, orbicular to widely obovate, margins not overlap-

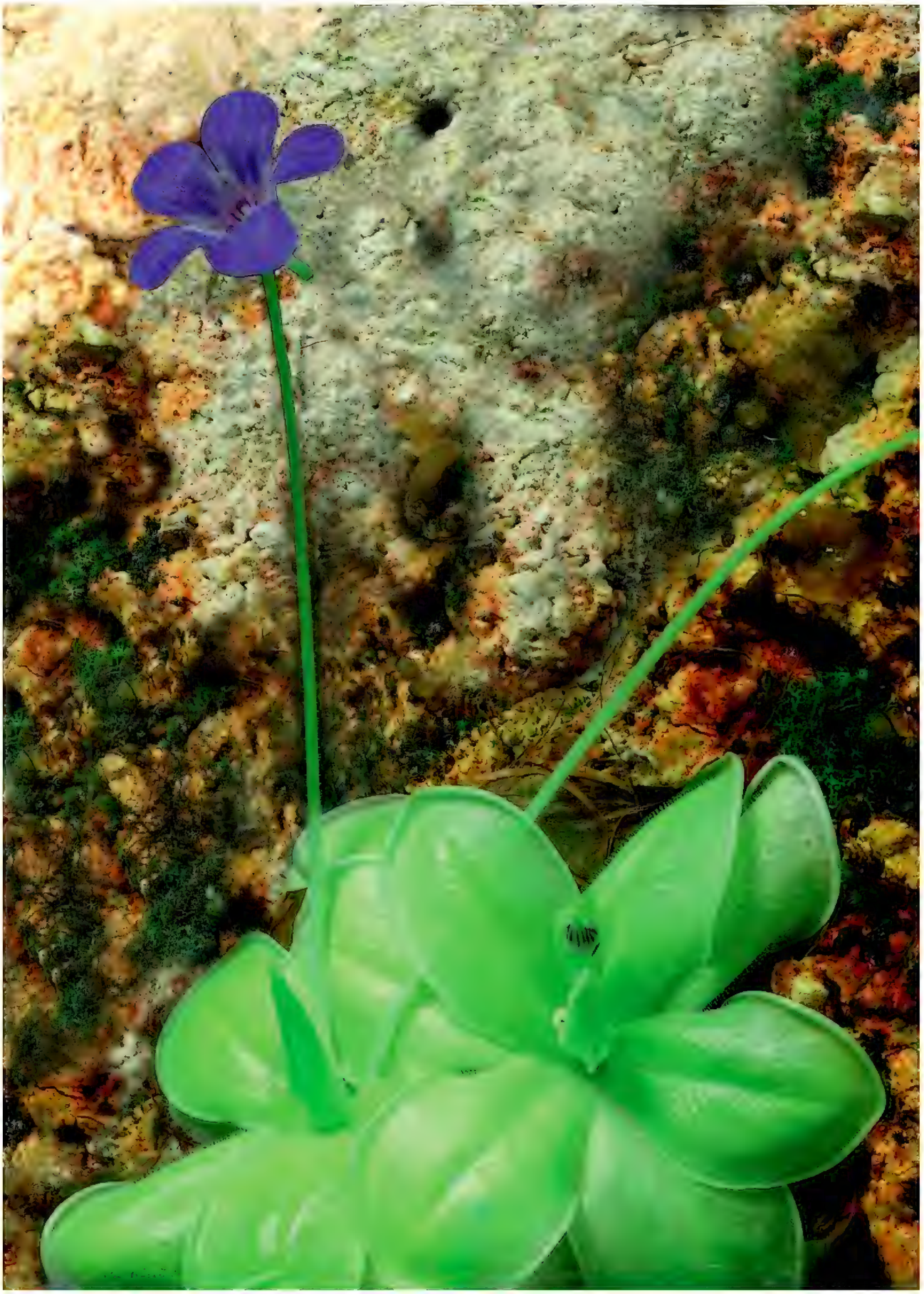

Figure 4: *Pinguicula jackii* in cultivation.

ping, 9–10.3 × 8–10.2 mm, shorter than the rest of the corolla, adaxial surface covered with stipitate glandular trichomes at the entrance of the tube; upper-lip 2-lobed, lobes a little smaller than the two lateral lower-lip lobes; lower-lip 3-lobed, lobes orbicular, apex obtuse to rounded, midlobe (8–)10–10.1(–10.3) × (9–)10.1–10.3(–10.5) mm. *Tube* very pale pink (or purple)-white, grey-purple veins, subcylindric, (8–)10.1–10.3(–10.4) × (8–)10.1–10.3(–10.5) mm, without palate; tripartite, the distal part widely open, densely covered with uniseriate simple trichomes, the middle part densely covered with simple uniseriate trichomes and uniseriate capitate trichomes, the proximal part sparsely covered with uniseriate simple trichome. *Spur* very pale green-beige, indistinct veins, distal end brown-green, 6–10 × 1 mm, slender, rounded at the tip, straight, continuing the tube. *Stamens* ± 1.5 mm long; anthers ± 1 mm wide. *Pollen* stephano-4–5-colporate. *Ovary* globose, sessile, ± 2.5 mm in diameter, 1-loculate, ending in a short style, moderately covered with stipitate glandular trichomes. *Stigma* short, 2-lobed, the lower lobe nearly orbicular, much larger than the upper lobe. *Capsule* globose, ± 5 × 5 mm. *Seeds* dark brown, ellipsoid, (0.32–)0-37–0.45(–0.47) × (0.37–)0.40–0.46(–0.50) mm, testa verrucose, micropylar appendage very short, sunken in a rounded seed end.

The similarly coloured *Pinguicula lithophytica* and *P. jackii* leaves are stronger green (less yellow) than those of *P. jaraguana* leaves. Trichome density varies between the three taxa. The *Pinguicula lithophytica* abaxial leaf surface is entirely and amply covered with trichomes; the emerging involute leaf (Fig. 5) exposes the abaxial surface, clearly revealing that trichomes are not limited either to the edge or to the main vein. While it has not been explicitly stated that trichomes are absent from *P. jaraguana*, no mention of the presence of abaxial leaf trichomes has ever been made, in particular by Casper (2003, 2019). However, we can now confirm that the analysis of fresh material and field observations reveal the absence of trichomes from the abaxial leaf surface of *P. jaraguana*. The presence of trichomes on the abaxial surface of *Pinguicula* is not common and has been reported in just a few species, which suggest it is an important feature in the discrimination of species.

The corolla of the three species is described as subisolobate or indistinctly 2-lipped, however, *P. jaraguana* shows a significant imbalance between the upper and lower lips (Fig. 6) while the corolla of *P. lithophytica* and *P. jackii* present an overall appearance of being almost balanced (Fig. 6). Moreover, *P. jaraguana* lobes overlap, from their bases, for between one third to one half of their length. *Pinguicula lithophytica* lobes overlap mainly close to the base or, occasionally, more so, though generally for significantly less than one third of the lobe length and *P. jackii* lobes do not overlap. In addition, the corolla face of *P. jaraguana* is white, deep purple-blue veins occurring

Figure 5: *Pinguicula jaraguana* (A), *P. lithophytica* (B), and *P. jackii* (C) showing emerging involute leaves with no trichomes on abaxial surface, ample abaxial trichomes and sparse trichomes along abaxial midrib, respectively. (Arrows indicate positions of midribs.)

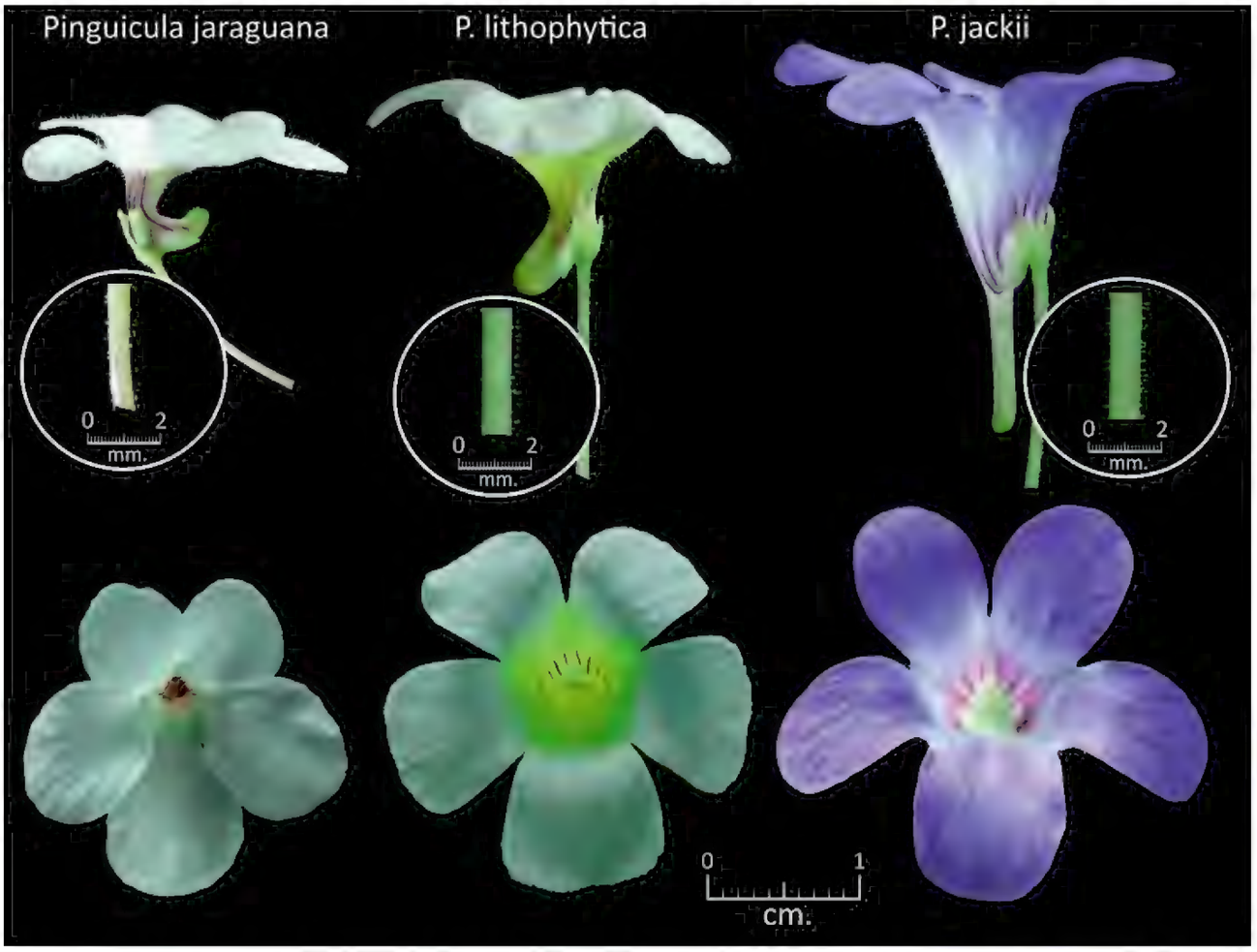

Figure 6: Flowers and scapes of *Pinguicula jaraguana*, *P. lithophytica*, and *P. jackii*.

only within the very pale blue-white (almost white) tube, while *P. lithophytica* shows an off-white (appearing white) corolla face with a yellow centre, sometimes with faint ± red-purple lobe margins, and dark yellow-brown veins within the yellow-green tube and *P. jackii* shows purple-blue lobes increasingly diffused with white toward their bases, with grey-purple veins within the pale pink (or purple)-white tube (Fig. 6).

During the preparation of Pinguicula of Latin America (Lampard *et al*. 2016), a major factor in the decision to merge *Pinguicula lithophytica* with *P. jaraguana* was related to interpretation of the differences in the angles that spurs present to the tubes (i.e., spur-tube angle) that were described as showing considerable intra-specific variation amongst Cuban taxa. A majority of authors held that spur-tube angle was unreliable as a discriminating taxonomic characteristic. This view was over-generalised and thereby misrepresented a significant difference as a result of inappropriately applying data from a sub-set of Cuban species to a wider range of taxa, without supporting evidence. To hold true, the claim of broad intra-specific spur-tube angle variation among all Cuban *Pinguicula* required demonstration. However, at least for some taxa, spur-tube angle can discriminate even at subspecies level, as is true, for example, for *P. filifolia* (Domínguez *et al*. 2014). Further, to merge *Pinguicula lithophytica* with *P. jaraguana*, based (in any part) on the claim that both present significant and overlapping variation in their spur-tube angles, requires evidence specific to this pair of taxa and should not be an assumption that is built upon characteristics evidenced in other taxa. While spur angles can be variable in some species (even to the extent that a single species may exhibit spurs presented at varying angles to the tube ranging between acute and obtuse), our observations and comparisons show *Pinguicula jaraguana, P. lithophytica*, and *P. jackii* do not show

such extremes of variation. *Pinguicula jaraguana* consistently presents its spur at an acute angle, *P. lithophytica* shows less spur-tube angle variation but, importantly, the spur is always presented at an obtuse angle. *Pinguicula jackii* bears a spur that consistently presents as a linear extension of the tube (Fig. 6). Thus, spur-tube angles represent a clear, significant, and consistent difference between these taxa.

The scapes of all three taxa show a clear difference in trichome density (Fig. 6). *Pinguicula jaraguana* is described as being only "sparsely" glandular (Casper 2019, p. 74), a subjective description that is open to broadly different interpretations. Comparison reveals that the *P. jaraguana* scape is least glandular, with *P. lithophytica* as intermediate, and *P. jackii* most glandular (Fig. 6), in a density ratio of c. 1:1.2:1.5, respectively. Scape diameter follows the same trend, sizes being c. 0.6 mm, c. 0.82 mm and c. 0.86 mm for *P. jaraguana*, *P. lithophytica* and *P. jackii* respectively.

Pinguicula jaraguana has a capsule that is clearly globose, whereas *P. lithophytica* has a capsule that, though ovoid at first (Fig. 7A) becomes spherical when mature (Fig. 7B). The capsule of *P. jackii* is variable among the specimens observed both in nature and in cultivation.

Representative seeds of *Pinguicula jaraguana, P. lithophytica* and *P. jackii* are shown in Fig. 8. Under equal lighting conditions, all three species, were observed to be dark brown, almost black, including both fresh and old seed of *P. jaraguana* and, notably, the seeds of *P. jaraguana* that were not golden, as previously reported by Casper (2019) but pale brown (Fig. 5A). Under normal lighting conditions, *P. lithophytica* and *P. jackii* seeds remained dark blackish-brown but small random areas or patches of golden colour were revealed when seeds were exposed to very bright light (Fig. 5B, C).

Together with the evidence provided by herbarium specimens (Table 1; Fig. 1), ample evidence is presented to demonstrate that the three taxa fully warrant their being considered as non-conspecific. Some of our redescribed characteristics for *Pinguicula jaraguana* reflect our belief that some original data was derived as a result of confusion with another taxon. Casper (2003, 2019) observed only preserved (dried) specimens. Considering *P. jaraguana* is only found in shade habitats (on wet vertical walls,

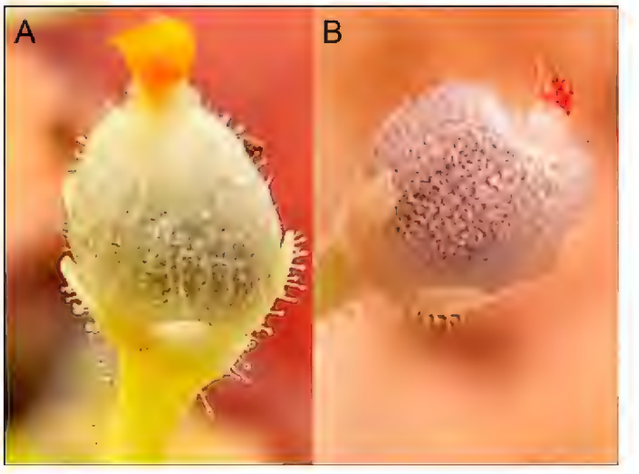

Figure 7: *Pinguicula lithophytica* capsule: immature (A); mature (B).

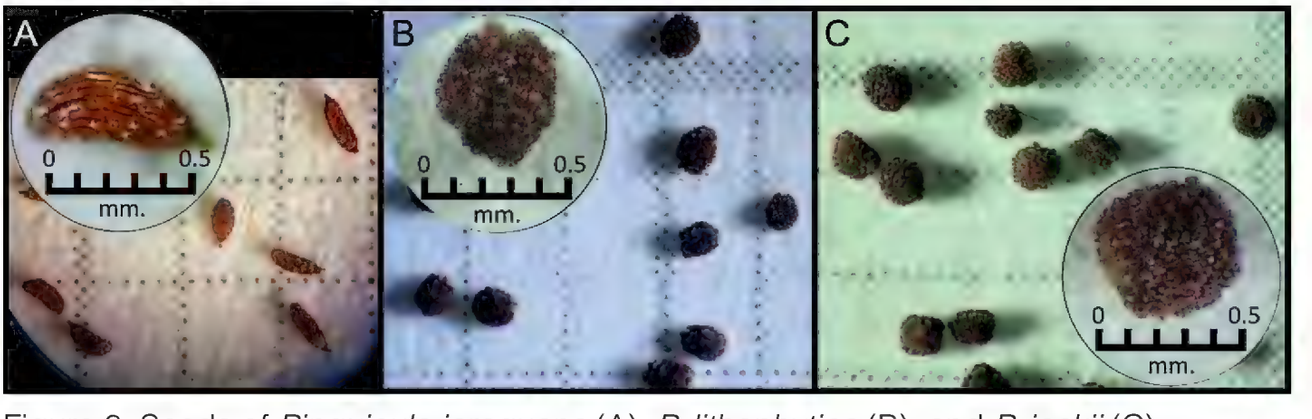

Figure 8: Seeds of *Pinguicula jaraguana* (A), *P. lithophytica* (B), and *P. jackii* (C).

generally associated with a thin layer of *Nostoc* sp. (Nostocaceae), a cyanobacterium, the original description of leaves "in open sun-exposed places often turning red" (Casper 2019) implies that some species other than *P. jaraguana* was being observed, probably *P. benedicta* (syn. *P. caryophyllacea* Casper, *P. toldensis* Casper). Of the remaining characteristics that we redescribe, some were not previously described (or had details omitted). Others apply to characteristics that were based on few specimens; our additional specimens have revealed additional data. In addition, we reject previous measurements of spur diameters that were made using pressed flowers.

Within his recent description of *Pinguicula jaraguana*, Casper (2019) described its capsule and seeds (although unaccompanied by any illustration or photograph):

> [*P. jaraguana*] *Capsule* ovoid c. 2 mm long c. 1 mm across, much longer than the persistent calyx. *Seeds* 0.5–0.6 mm long, 0.2–0.3, thick, golden ventrally flat, dorsally convex, testa reticulate, forming a raised network of narrow and sharply angled lines (c. 10) longitudinal rows of right-angled honeycomb interspaces, each depression corresponding an interspace; with single micropylar appendage.

The description of seeds as "ventrally flat, dorsally convex" is contradicted and may be explained by our observations of old herbarium specimens that revealed seeds that appeared excessively dehydrated and damaged, having abnormal or deformed shapes, often with both flat and convex sides. We are aware that Casper only had access to old seeds of *P. jaraguana* from herbarium specimens. Therefore, we believe Casper's description resulted from his having observed only old, highly desiccated and damaged material that does not accurately represent the shape of fresh seed.

From these descriptions, clear differences can be identified among the three species (Table 2).

As had already been discussed and published (Lampard *et al*. 2016), the distinctly different sub-tropical and humid habitats of *Pinguicula lithophytica* and *P. jaraguana* are limited to the Escambray mountains and Macizo Sagua-Baracoa or Sagua-Baracoa Massif, respectively (Fig. 9). Lampard *et al*. (2016) confusingly described two separate and distinct habitat regions as both belonging to *P. jaraguana* by regarding *P. lithophytica* as conspecific with the former. A brief mention of a biological barrier between the two regions was included but not fully nor accurately described. The Escambray is widely separated from the eastern ranges, the Macizo Sagua-Baracoa and the neighbouring Sierra Maestra — both of which represent sub-tropical cloud forest environments — by the tropical and relatively dry, lowland, Central-East Plain (Planicie Centro-oriental), also but less commonly known as the Camagüey Manaibón (López Almirall *et al*. 1994). The lowland expanse measures c. 250 kilometres long (east-west) and spans the entire area between the north and south coasts. Its impact has long been understood by Cuban botanists but seldom by others. Although the plain does not present a severe impediment to colonisation and spread by plant species, it is a very significant barrier for some, in particular for a group characterised as serpentine flora (López Almirall *et al*. 1994) that includes all terrestrial east-Cuban *Pinguicula*, including *P. jaraguana*.

All the eastern *Pinguicula* species have very limited distributions characterised by serpentine (or ultrabasic) soil — except for the epiphytic *P. lignicola*. Even the modest distances between the various eastern serpentine areas are sufficient to cause isolation of *Pinguicula* populations, such that they become specialised to unique microhabitats, resulting in an unusually high number of species within close proximity, all eight serpentine populations occurring in an area of c. 1350 km^2, a density of c. 1/169 km^2 (excluding the epiphytic *P. lignicola*). Compared with gaps between local eastern serpentine habitats, the Planicie Centro-Oriental presents an even stronger barrier as it separates the eastern and central serpentine habitats by a significantly greater distance as well as offering a comparatively drier climate; all east-Cuban *Pinguicula* occur in habitats that are humid combined with

Table 2. Key characteristics of *Pinguicula jaraguana*, *P. lithophytica*, and *P. jackii*.			
	Pinguicula jaraguana	*Pinguicula lithophytica*	*Pinguicula jackii*
Rosette diameter	± 40 mm.	± 120 mm.	± 100 mm.
Leaf type	homophyllous, with carnivorous leaves exhibiting seasonally different shape and size.	homophyllous, with uniform carnivorous leaves all year round.	homophyllous, with uniform carnivorous leaves all year round.
Leaf size	± 20 × 8.5 mm.	± 60 × 44 mm.	± 50 × 30 mm.
Leaf abaxial surface	Glabrous.	Whole leaf surface sparsely covered with stipitate glandular trichomes.	Middle vein sparsely covered with stipitate glandular trichomes.
Flower colour	White.	White with yellow throat.	Blue-violet.
Corolla	More or less rotate.	Almost bell-like.	Almost oblique bell-shaped.
Tube	Short, ± 3.5 × 2 mm.	Medium size, ± 4.5 × 3 mm.	Long, ± 10 × 10 mm.
Spur	Very short, ± 4.5 × 2.5 mm.	Medium size, ± 5.5 × 4 mm.	Long, 8 × 1 mm.
Spur-tube angle	Acute.	Obtuse.	Straight.
Capsule	Globose, ± 3.5 × 3.5 mm.	Ovoid, ± 5 × 4 mm.	Globose, ± 5 × 5 mm.
Seed	Fusiform, testa reticulate, micropylar appendage prominent.	Ellipsoid, testa verrucose, micropylar appendage prominent.	Ellipsoid, verrucose, micropylar appendage very short.

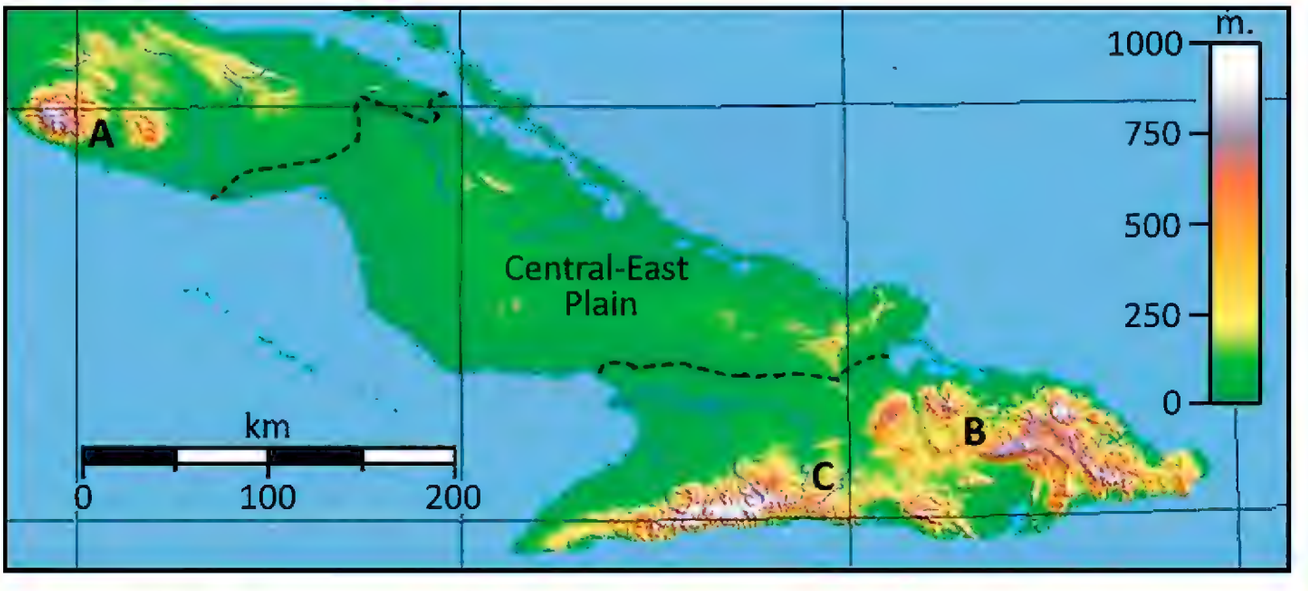

Figure 9: Central and eastern Cuba. The Central-east Plain separating the Escambray mountains (A) in Central Cuba from the Sagua-Baracoa Massif (B) and Sierra Maestra mountain range (C) in Eastern Cuba (map modified from Mapsland.com, 2021).

being seasonally or permanently wet. The plain's temperature is a further constraint; at no point do hills within the Planicie Centro-Oriental rise even to three hundred metres, never coming close to being a mountainous region with an altitude and corresponding lower temperature resembling those in which taxa from the Escambray and Macizo Sagua-Baracoa — including *P. lithophytica* and *P. jaraguana* respectively — live. The Planicie Centro-Oriental experiences typically tropical conditions while the two *Pinguicula* occur at altitudes that are sub-tropical with clouds enveloping the flora at night.

The differences in *Pinguicula lithophytica* and *P. jaraguana* habitats further support their being separate species. *Pinguicula lithophytica* is found on degrading coral-rock seeps, wet during and just after rains but relatively much drier in the absence of recent rain. Plants can withstand long periods of drought, surviving mainly on humidity, even while no rain falls for a month or more. *Pinguicula jaraguana* grows in or by streams, in permanently wet ultra-basic soil.

As previously stated, the name *Pinguicula lithophytica* has also been relegated as a synonymous name of *Pinguicula jackii* var. *parviflora* by Shimai (2017). This was rejected by Casper (2019) with the vaguest explanation: "Ich habe keine entsprechenden Belege geschen [I haven't seen any corresponding herbarium specimens]". More specifically, *Pinguicula jackii* var. *parviflora* was first published by Ernst (1961) without designating a type, breaching Art. 40.1 of the International Code of Botanical Nomenclature (ICBN) - Paris Code (Lanjouw *et al.* 1956). A subsequent effort to use Ernst's invalid name was made by Shimai (2017; p. 292) by assigning a neotype but the attempt was not effective as it was contrary to the requirements of Art. 29.1 of the ICN (McNeill *et al.* 2012; Turland *et al.* 2018). No attempt to validate such name is known and since a name has no priority outside the rank at which it is published (Art. 11.2 ICN, Turland *et al.* 2018), even if validated at some point, it would not threaten *P. lithophytica* as the first and hence priority name of the taxon on species rank.

Conclusion

Newly described evidence has reinstated *Pinguicula lithophytica* while *P. jaraguana* is redescribed so as to amend and expand details of its characteristics. Using the correct and expanded details, the distinct differences in seed shape, trichome density on scapes, leaf size and the presence, density and distribution of trichomes on abaxial leaf surfaces, and flower characteristics are sufficient to demonstrate that *P. jaraguana* and *P. lithophytica* are distinct species. The invalid publication of "*P. jackii* var. *parviflora*" was not resolved by a subsequent ineffective attempt at typification and that name therefore remains invalid.

Acknowledgements: All figures are credited to the authors with the exception of Fig. 9 that presents an edited version of an original map from Mapsland.com, 2021. We are greatly indebted to Geovanys Rodríguez Cobas (Head of the Baracoa Department), Jorge Luis Delgado Labañino (Head of the La Melba Department), Noel Coutin Lobaina (Installation Guide), and Wisdenilde Navarro Méndez (Park Ranger of Protected Areas), all being employees of the Unidad de Servicios Ambientales Alejandro de Humboldt [Alejandro de Humboldt Environmental Services Unit] — a part of the Ministry for Science, Technology and the Environment [CITMA]) — who obtained permits and gave up a significant amount of their time to act as local guides; without their contributions, this work could not have been undertaken or completed. We are also very grateful to Aliesky Gil Carballo and Rayner Rodriguez Diaz, for their assistance with regard to Cuban geography, to John McNeill for his expert opinion on the rules of botanical nomenclature

as they affect the plant names discussed above, to Amar Dravid for his precise colloquial translation of Casper's written German, and to Christoph Belanger, for his recommendations on some photography techniques.

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Appendix I — Examined specimens (herbarium acronyms following Index Herbariorum)

Pinguicula jackii – CUBA, Cienfuegos: Province of Santa Clara, Las Lagunas, Buenos Aires, about 2500 ft. alt., 5 Dec 1928, *J.G. Jack 6794* (US!); 7 Mar 1929, *J.G. Jack 6794* (US!); 25 Apr 1930, *J.G. Jack 7942* (US!); San Blas, 17 Mar 1929, *L.H. Bailey 12443* (BH!, NY!); Buenos Aires, Trinidad Mts. 10 Jul 1929, *W.W. Bangham s.n.* (A!); Trinidad Mts, alt. 3000 ft. 12 Mar 1930, *F.W. Hunnewell 11477* (GH!); Buenos Aires, paredones de los mogotes, 4 May 1932, *J.T. Roig & J. Acuña 6107* (HAC-Roig!); Lomas de Trinidad, 15 May 1932, *J.T. Roig & J. Acuña 12916* (HAC-SV!); Vicinity of La Sabana, Buenos Aires, Trinidad Mountains, 5 Aug 1936, *L.B. Smith et al. 3388* (US!); Trinidad Mountains, San Blas-Buenos Aires, Aug 1941, *R.A. Howard 6451* (C!, GH!, NY!, P!, S!, US!); Las Vegas de Mataguá, Trinidad Mountains, 22 Feb 1959, *C.V. Morton 10527* (US!); Las Villas, Grupo de Trinidad, Kalkfels-Hügel 5 km nw des Topes de Collantes, 800 m, 19 Feb 1968, *Kukan-Dtsch. A. v. Humboldt-Expedition 1245* (GAT!); La Sierrita, Sabanilla, caminos y farallones en la finca La Cueva, 700–900 msm., 7 May 1977, *J. Bisse et al. HFC 34920* (HAJB!); Mun. Cumanayagua, Carso de Buenos Aires, Loma Las Lagunas, 21°59′20′′N, 80°11′30′′W, 750 m., 17 Aug 2014, *B.M. Torke et al. 1451* (NY!); Province d'Oriente, s.d., *s.coll.* (MT!); Without information, s.d., *s.coll.* (HAC-LS!).

Pinguicula jaraguana – CUBA, Holguín: Prov. Oriente, Palenque, Cuchillas de Toa, Cayo Fortuna, a lo largo del río Toa, Abr 1970, *J. Bisse HFC 16747* (HAJB!); *J. Bisse HFC 16918* (HAJB!); Palenque, Cuchillas del Toa, Cayo Fortuna, Río Toa, después de la entrada del arroyo Cayo Fortuna, 25 Mar 1972, *H. Lippold HFC 21649* (HAJB!); Mun. Moa, Sierra de Moa, La Melba, Arroyo Jaragua, 25 Feb 1979, *J. Bisse et al. HFC 39913* (B!, JE!); Palenque, Cuchillas de Toa, Cayo Fortuna, pinares y charrascales en el trillo de Riito a Piloto Arriba, Apr 1972, *R. Berazaín & J. Bisse HFC 21959* (HAJB!, JE!); Moa, Alrededores de la Mina Mercedita cabezadas del río Jiguaní, 19 Apr 1985, *A. Álvarez et al. HFC 56240* (HAJB!, JE!).

Pinguicula lithophytica – CUBA, Cienfuegos: Province of Santa Clara, Naranjo, Buenos Aires, Trinidad Hills, 2500–3500 ft. alt., 10 Apr 1930, *J.G. Jack 7886* (CAS!, SYSU!, US!); Buenos Aires, paredones de los mogotes, 4 May 1932, *J.T. Roig & J. Acuña 6261* (HAC-Roig!); Trinidad Mountains, limestone hills near El Naranjo, alt. c. 900 m., 18 Jul 1953, *G.L. Webster 205* (HAC-LS!, MICH!, S!, US!); San Blas, El Sopapo, Los Tornos, 28 Feb 1995, *C. Panfet et al. HFC 71790* (HAJB!).

ICPS Roundtables

https://doi.org/10.55360/cpn522.kc202

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For the past couple of months, I have been hosting virtual roundtables with 3-5 expert scientists, growers, and conservationists from all over the world. All videos can be viewed on the ICPS YouTube channel: https://www.youtube.com/user/icpstv. For discussions that were shorter than 1 hour, the videos are also published on our Facebook page https://www.facebook.com/InternationalCarnivorousPlantSociety/videos.

The response has been great! Check out some of these comments:

@Tommyr: "Excellent show!"

@super-jojo: "This video was insane! So amazing to see experts of the field discussing together."

@EarthsGeomancer: "These videos are so valuable. Thanks for the hard work in organizing them! It's like an Avengers team of Sarr breeders. Wow. Thanks for organizing this. Really enjoyed it!"

@HerebutNot: "Great talk – nice to hear the exploration of these topics from different perspectives."

@jayholmes46: "Great panel! Very much enjoyed it, thank you ICPS! I really like the variations on responses. It surfaced the creativity of everyone. Thank you all."

@dmitrykutcherov8546: "Really enjoyed the roundtable and looking forward to more such informative and inspiring talks."

I hope you watch them and find value in them for yourself. My vision is for you to get a glimpse behind the curtain. You get to hear shoptalk – what has worked and maybe more importantly what hasn't. Moderating these international panels which contain different levels of expertise and experiences has been very educational for me. I hope they help you too. That is what being an ICPS member is all about. We want to give you a premium education on anything and everything related to carnivorous plants. If you have a topic or an expert or two in mind, please send me an email.

Breeding *Nepenthes* ICPS Roundtable
Growing highland *Nepenthes* ICPS Roundtable
Breeding *Sarracenia* ICPS Roundtable
Growing *Byblis* ICPS Roundtable

Carnivorous plants and conservation – the role of carnivorous plant enthusiasts

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Keywords: poaching, illegal plant trade, wild collections, *in situ* conservation, *ex situ* conservation, species introductions, neophytes.
Received: 5 December 2022
https://doi.org/10.55360/cpn522.af323

Abstract: Carnivorous plants and their unique habitats face various threats, most of them being anthropogenic. About 25% of the known 860 carnivorous plant species are threatened or face extinction. Two of the threats are predominantly caused by "carnivorous plant lovers". The actions include 1) sale and trade of plants that have been illegally collected from the wild, a threat that has continuously increased in the past years and 2) planting of exotic carnivorous plant species into pristine habitats of native species. This article illustrates these problems and shows causal connections and the legal situation, which are apparently not known to everyone. A long-term solution can only be found if carnivorous plant lovers recognize and stop their misconduct. This article aims at closing knowledge gaps and to inform about the problem of threats to wild carnivorous plant populations by carnivorous plant lovers.

Introduction

Of the 860 known species of carnivorous plants (CPs), more than a quarter are threatened with extinction in the wild: 69 carnivorous plant species (8%) are currently classified as Critically Endangered (that is, facing extinction), 47 species (6%) as Endangered (that is, likely facing extinction if their current decline continues) according to the IUCN Red List (= the global Red List of categories of threat to all living beings), 104 species (12%) as Vulnerable, and 23 (3%) as Near Threatened (Cross *et al*. 2020). At least 89 species of CPs are known from only a single locality worldwide (so-called microendemics). If the localities get destroyed, these species will become globally extinct (Cross *et al*. 2020). Threat categories to CPs in their natural habitats are diverse (Fig. 1), but nearly all causes of threat are purely anthropogenic (Jennings & Rohr 2011; Clarke *et al*. 2018; Cross *et al*. 2020) – just as generally the survival of nearly all organisms in the Anthropocene era is influenced by the vast human impacts on global ecosystems.

This article focuses on two threats to CPs that come from "carnivorous plant lovers", and which sadly are the main threats to the survival of certain CP species in the wild! At least 126 CP species worldwide are threatened by human disturbance of their habitat (i.e., land use, development, pollution, agriculture, forestry, mining, but also including poaching and invasive species), and at least 98 CP species are threatened mainly by having their populations plundered for the illegal plant trade for "CP lovers" (Cross *et al*. 2020; Fleischmann 2021). These are, of all things, species that would otherwise be relatively safe in their habitat because they are located in protected areas, where they would actually be largely spared from other negative human impacts.

This article is adopted and updated from an article written for the German CP society magazine "Das Taublatt" in 2021 (Fleischmann 2021). Sadly, many more reports of man-made habitat loss,

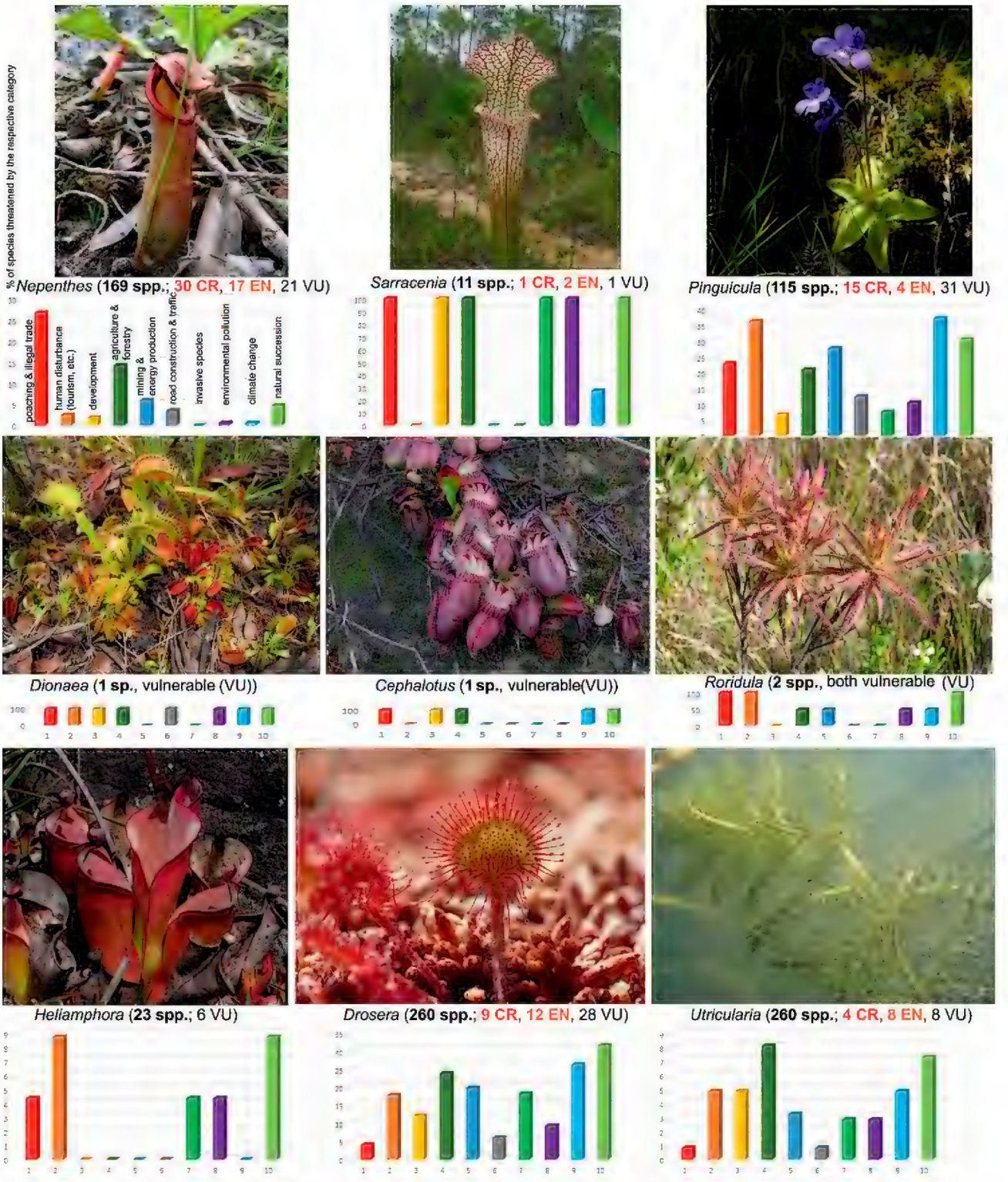
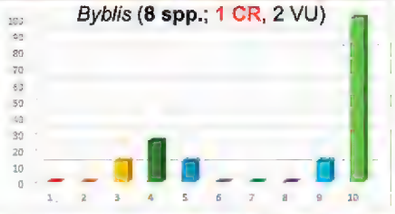
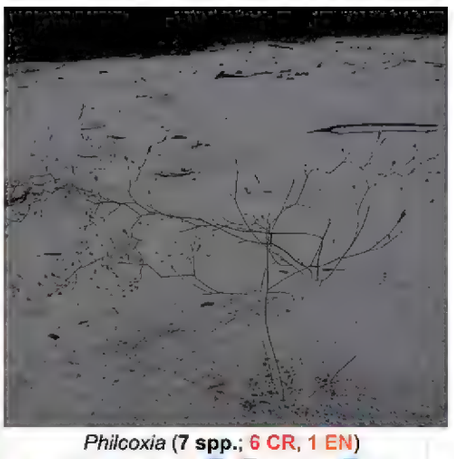

% of species threatened by the respective category
poaching & illegal trade
human disturbance (tourism, etc.)
development
agriculture & forestry
mining & energy production
road construction & traffic
invasive species
environmental pollution
climate change
natural succession
Nepenthes (169 spp.; 30 CR, 17 EN, 21 VU)
Sarracenia (11 spp.; 1 CR, 2 EN, 1 VU)
Pinguicula (115 spp.; 15 CR, 4 EN, 31 VU)
Dionaea (1 sp., vulnerable (VU))
Cephalotus (1 sp., vulnerable(VU))
Roridula (2 spp., both vulnerable (VU)
Heliamphora (23 spp.; 6 VU)
Drosera (260 spp.; 9 CR, 12 EN, 28 VU)
Utricularia (260 spp.; 4 CR, 8 EN, 8 VU)

Figure 1: (left and right): Main categories of threat for each CP genus in the wild. The length of the bars corresponds to the number (in %) of species from the genus that are endangered by the respective cause. For example, more than a quarter of all known *Nepenthes* species are threatened by poaching and illegal plant trade! Below each photo, the total number of species for each genus, as well as the number of species under an IUCN Red List category of threat (CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC =Least Concern). Data basis from Cross *et al.* 2020; graphics and photos: A. Fleischmann.

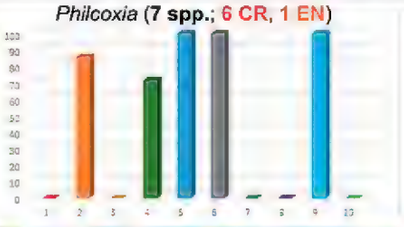
Genlisea (**30 spp.**; 3 CR, 2 EN, 3 VU)

Byblis (**8 spp.**; 1 CR, 2 VU)





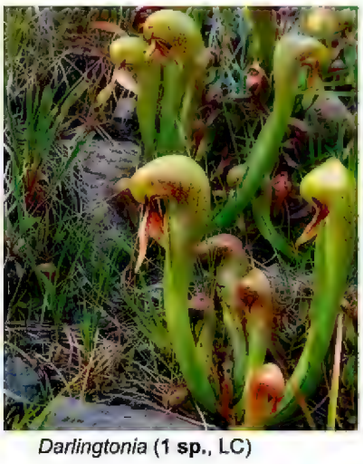
Philcoxia (**7 spp.**; 6 CR, 1 EN)



Aldrovanda (**1 sp.**, EN)

Triphyophyllum (**1 sp.**, threat category unknown)

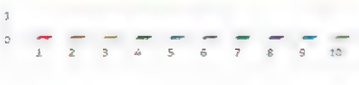
Drosophyllum (**1 sp.**, NT)



Darlingtonia (**1 sp.**, LC)

Brocchinia (**2 spp.**, LC)

Catopsis (**1 sp.**, LC)



poaching, illegal plant trade and CP habitat spoiling by naturalized non-locally native species have become evident to the author since the 2021 article.

Threats to carnivorous plants due to illegal collection from the wild

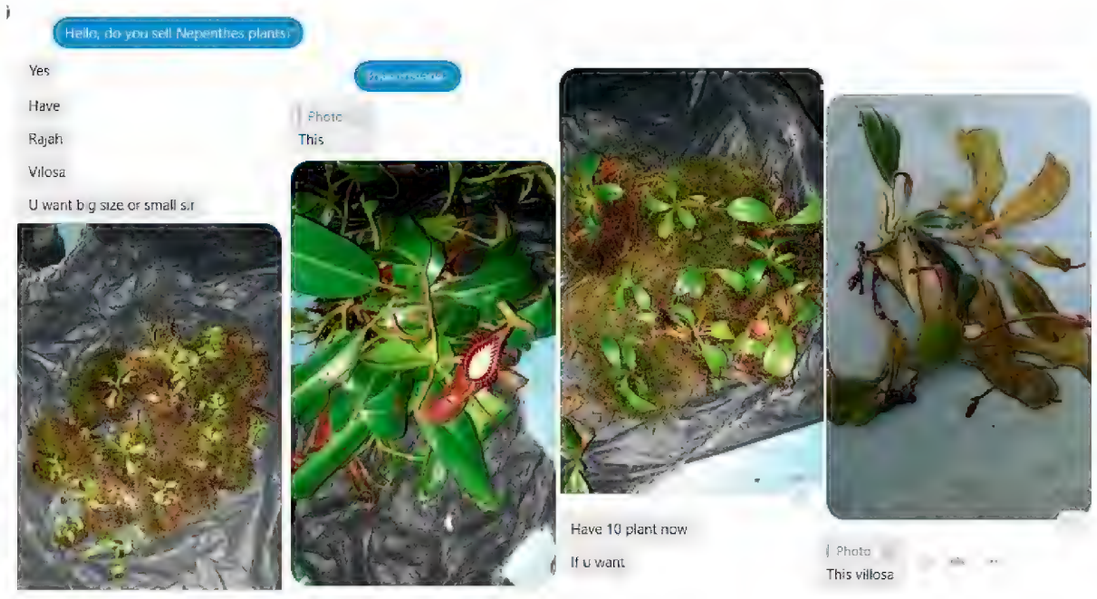
Carnivorous plants, along with orchids, cacti, bromeliads, and cycads, suffer very concrete threats to individual species due to a high horticultural interest in growing these interesting plants (Simpson 1995; Clarke *et al.* 2018; Cross *et al.* 2020). There is hobbyist interest especially when it comes to spectacular, rare, or "new" species. Illegal collecting activities, sometimes on a commercial scale, continue to bring some populations or even species to extinction. This happens both by an increasing number of individual private collectors or plant hunters, and also on a large scale by illegal poaching for commercial sale by plant dealers. These dealers offer the illegally wild-collected plants or seeds on online marketplaces such as Facebook, eBay, and Etsy (eBay claims to control and ban the offer of wildlife and wild-collected plants for trade; eBay 2021). Particularly endangered by this are *Nepenthes* species (Figs. 2–4; Simpson 1995; Clarke 1997, 2001; Clarke *et al.* 2018; Cross *et al.* 2020; McPherson 2022a; Carnivorous Plant Poachers 2023), especially in Borneo, Sumatra, the Philippines, and Indochina. But also tuberous *Drosera* and "location forms" of *Cephalotus*, *Sarracenia* and *Dionaea* are illegally taken from the wild on a large scale to be sold (Clarke *et al.* 2018; see Fig. 5). The customers are CP growers all over the world who are probably aware where their "goods" come from. Practically all commercial trade of wild collected CPs is illegal in spite of what the sellers so often claim! In Australia, for example, the commercial export of Australian plants (which includes CPs) taken from the wild has been prohibited for 20 years (EPBC Act 1999), despite many of them appearing on well-known sales lists or internet sites. In most countries, the acquisition of illegal wild collections is treated the same as the purchase of stolen goods: a) the customers should carefully inform themselves about the legality of the source before buying, b) ignorance is no excuse c) a buyer can never acquire legal ownership of illegally poached species which are subject to confiscation by legal authorities. If illegal plants are seized, the consumer's money is lost and fines, and other penalties, or even imprisonment can result.

The following are the most commonly brought up arguments or excuses by growers for the purchase of illegal wild collections. These excuses are mostly to convince themselves of a good conscience for their action. None of these arguments are defensible…

False argument 1: "Their natural sites will get destroyed anyway by habitat destruction and climate change, so it's good if the plants will be saved."

In principle, this would make up the most sensible argument, but it just doesn't stand scrutiny. Almost all illegal collections of CPs that have become evident in the past years were made in protected areas (such as nature reserves) and/or in very inaccessible regions, such as remote mountain tops in SE Asia or wilderness areas of Western Australia, i.e., in areas that are largely safe from habitat destruction. These protected or remote sites are where the long-term survival of these plants in the wild would be ensured, and this is exactly where many CPs are getting poached for the illegal trade—often done on a large scale. On an alarmingly large commercial scale this is affecting *Nepenthes* in the protected areas of Borneo, Sulawesi, in Indochina, or in the Philippines. Unfortunately, species like *N. edwardsiana* or *N. clipeata* in the wild are not endangered because their habitats are being destroyed—it is because there are certain people out there (call them "plant enthusiasts", "plant collectors", "CP lovers", or by the words of Barry Rice: "CLODS", see Meyers-Rice 1996)

Figure 2: (Left): This large *Nepenthes* × *kinabaluensis*, illegally plundered from site on Mt. Kinabalu, Borneo, was offered for several hundred dollars on Facebook by a professional poacher in 2022 – together with a long and sad sales list of many more illegal wild collections of many other rare *Nepenthes* species from Borneo, the Philippines and Papua. Any CP grower purchasing such plants should be aware that they are obtaining illegal material and are involved in criminal actions that violate international biodiversity laws, endangered species protection laws (CITES) and national customs regulations. High fines and confiscation of such purchased illegal material (including the rest of the private CP collection, as customs officers might not be able to tell apart legally obtained material from illegal internet buys) can await the customer of such offers. Photo: screenshot from Facebook. (Right): Bundles of *Nepenthes ephippiata* adult vines cut into pieces by the poachers in Borneo, ready for being shipped to unscrupulous overseas customers of this illegal business. In this case, the mass poaching of hundreds of plants was ordered and collectively paid by a Chinese commercial nursery from Tianjin Province (see McPherson 2022b). Photo provided by Stewart McPherson.



Rajah this

How much for rajah?

Same price sir

What location are they from?

Between mount kinabalu n tomboyokon sir

Also for edwardsiana?

Yes sir

Figure 3: (this and previous pages): Some examples of the unfortunately very prosperous illegal trade with poached *Nepenthes*, which document that there is not only an increasing offer of such illegally collected plants by poachers, but also a high demand for these by some CP growers, who specifically ask for these wild collections. Compilation of screenshots from Facebook offers made in 2020 by various "plant dealers" and their customers. Shown here are illegally taken young and old plants of *Nepenthes rajah*, *N. edwardsiana*, *N. villosa* (these three Bornean species are all protected by law, trade of these wild-collections is prohibited by CITES, and moreover they were poached from a National Park!), *N. rigidifolia* and *N. ampullaria*.

Figure 4: Poached plants of the last remaining individuals of *Nepenthes clipeata* from Mount Kelam, Borneo, in 2020. This parcel was addressed to an illegal wild-trade customer in Taiwan, a notorious local nursery owner who specializes on selling wild-collected Southeast Asian plants. The shipment got confiscated by local police and conservationists tried to replant the plants (see McPherson 2022b). Photo provided by Stewart McPherson.

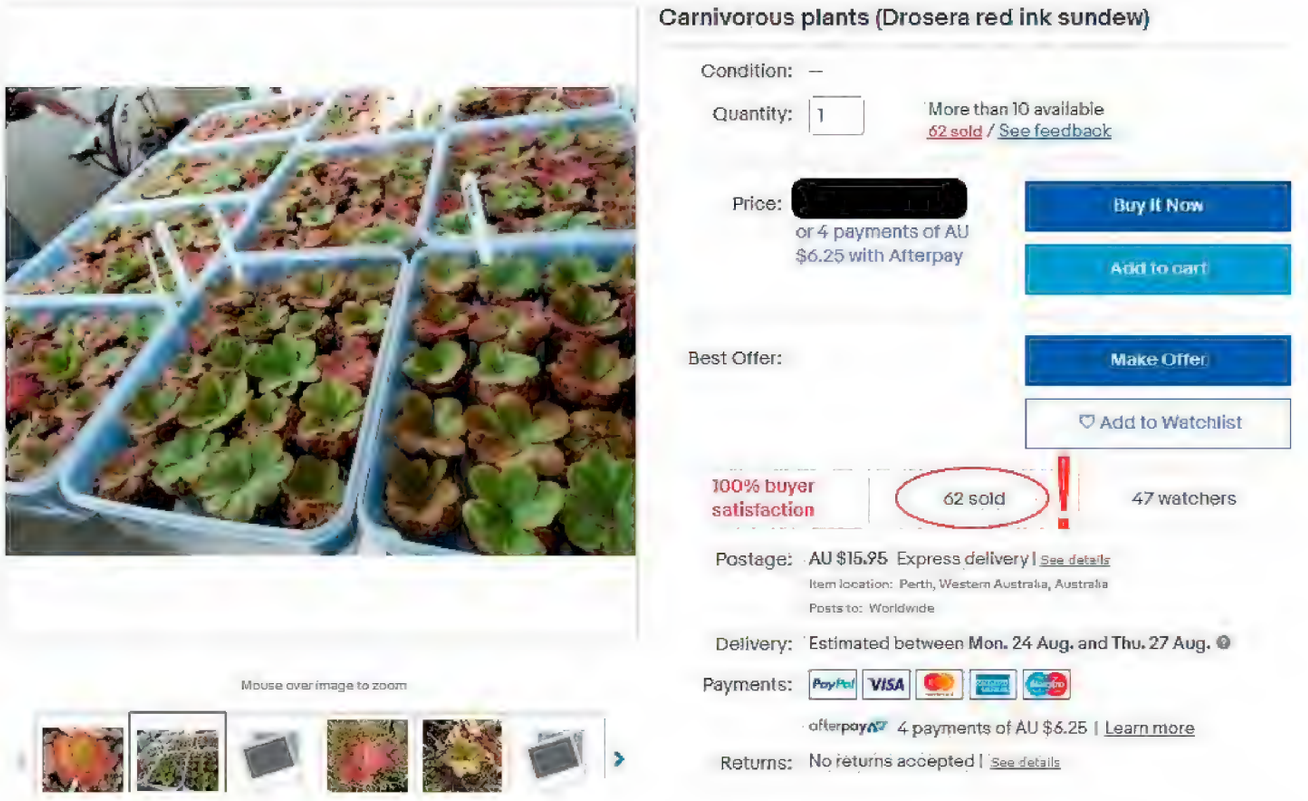

Carnivorous plants (Drosera red ink sundew)
Condition: –
Quantity: 1
More than 10 available
62 sold / See feedback
Price:
or 4 payments of AU $6.25 with Afterpay
Buy It Now
Add to cart
Best Offer:
Make Offer
Add to Watchlist
100% buyer satisfaction
62 sold
47 watchers
Postage: AU $15.95 Express delivery | See details
Item location: Perth, Western Australia, Australia
Posts to: Worldwide
Delivery: Estimated between Mon. 24 Aug. and Thu. 27 Aug.
Payments:
afterpay 4 payments of AU $6.25 | Learn more
Returns: No returns accepted | See details
Mouse over image to zoom

Figure 5: Examples of the sale of illegally excavated tuberous *Drosera* in Western Australia on an internet platform (screenshots), done professionally on commercial scale. This seller even explicitly stated in his sale description that these were wild collections and cited an alleged "official permit". By Australian law, any sale of wildlife removals is strictly prohibited. Despite – or perhaps rather because of? – the indication that these were wild-collected specimens, specimens were purchased by CP growers all over the world – in the case of *Drosera collina* pictured above, at least 62 times.

who buy wild-collected *Nepenthes* stolen from their natural habitats, and by doing so create and support a market for these illegal activities.

Ironically, by their actions these self-termed "plant lovers" ensure that the plants they actually claim to admire so much will perish from the wild! To emphasize: some rare and endangered CP species, such as *Nepenthes aristolochioides*, *N. clipeata*, *N. diabolica*, *N. edwardsiana*, *N. erucoides*, *N. hamata*, *N. inermis*, *N. izumiae*, *N. jamban*, *N. jacquelineae*, *N. pitopangii*, *N. rigidifolia*, *N. tenuis*, *N. undulatifolia*, etc. (Cross *et al*. 2020; McPherson 2022a, b; A. Robinson, pers. com.) will become extinct in the wild only because there are people who desperately want to own them in their CP collections no matter what, and therefore do not hesitate to buy wild collected specimens!

For example, there is a high demand for wild-collected plants of *N. clipeata* among certain CP growers in Asia, the USA, and Europe, and the habitat of this Critically Endangered species, a single hill-top in Borneo, although a protected area, is comparatively easily reached, hence populations are under massive threat by illegal collections. The single known population of this species has undergone a massive decline by poaching, and by 2019 only 18 individuals of this unique species were left in the wild (Mansur *et al*. 2021). Nevertheless, illegal collection of these last reminders for the illegal commercial trade continued, with a big poaching event being documented in 2020 (McPherson 2022b; Fig. 4). *Nepenthes clipeata* most likely has to be declared extinct in the wild by now, and this loss has to be entirely attributed to certain CP growers or customers of such wildlife offers.

Paradoxically, in these cases it is undeniably the "CP lovers" who constitute the biggest threat to the survival of these species, and who are responsible for the decline and extinction of certain (rare)

species which they claim to love so much! In the case of *Nepenthes*, illegal trade of wild-collected plants represents the strongest threat and the main reason for the extinction of individual species in their natural habitat (see Fig. 1). More than a quarter (27%) of the known *Nepenthes* species today are endangered by poaching and illegal wild trade (Cross *et al.* 2020). It is us, the CP growers, who will be responsible for the loss of these species from the wild! Likewise, any so-called "location forms" of *Cephalotus*, as well as various tuberous *Drosera*, that are offered as exceptional "legal wild collections" from Australia are in fact illegally taken, in several cases even from protected areas. Any buyer should be aware that there is not an infinite number of plants of these species at each of their natural locations and that any removal of these species will bring them closer to extinction.

As mentioned earlier, the export of plants for the commercial trade is generally prohibited in Australia and also in almost any country that is home to *Nepenthes*. In response, some resourceful dealers relabelled their wild-collected material as "cultivars" or "cultivated hybrids", hoping to escape the legislation. Unfortunately, more and more imitators followed—in Western Australia recently an internet supplier of wild collected tuberous *Drosera* (who also exported them internationally) publicly boasted that he had "legal permits" and would also get them for Nature Reserves. This is a bald-faced lie, because in Western Australia any trade in wild-collected plants taken from conservation areas is prohibited, with fines of AU$ 50,000 for non-protected species and AU$ 500,000 for strictly protected species (Biodiversity Conservation Act 2016). Wild-collected plants of *Sarracenia*, *Dionaea*, and many *Drosera* offered for sale online also come almost exclusively from protected areas. Here, too, it must be clear to every buyer where these plants come from, and that by buying them they contribute to the loss of these species in the wild.

False argument 2: "Now that the plants have already been dug up anyway, I've only bought them to save them, otherwise they would have died in vain in the seller's possession."

This excuse is also window dressing. As hard as it sounds, only if no one buys these wild-collected offers, will the dealer eventually stop plundering plants in their natural habitat—even if all poached plants must perish in the hands of the illegal dealer. Every purchase, no matter how well-intentioned, creates the market that will eventually kill-off our beloved CPs in their natural habitat. It's like the sad trade with baby turtles illegally poached from the wild that are offered for sale to tourists at weekly markets in parts of the Mediterranean. Some tourists buy some out of pity and release them back into the wild, believing they have done a good deed. Exactly the opposite is the case: for the seller this is an incentive to continue with the illegal taking of wild animals, because they are able to make a business out of it. It is the same with the illegal taking of CPs from the wild.

As long as there is someone to purchase the poached plants, there is an incentive for the poachers to continue. Culturally, this is quite understandable, since the often comparatively high sums paid for these plants are good reward for the local people who have a comparatively low income stream, e.g., in Indonesia.

False argument 3: "I want to grow different location-forms/clones, because this way I can contribute to the conservation of this species, so that it will survive at least in cultivation."

The argument of "private *ex-situ* conservation" is also not tenable. *Ex-situ* conservation, i.e., the sole preservation of a species in horticultural cultivation, can only be the last option if survival of a species in the wild is no longer possible at all (IUCN/SSC 2014). *In-situ* conservation, i.e., the protection of a species in its natural habitat, should always be regarded as the first and ultimate conservation goal. Only *in-situ* can the whole ecosystem including all associated organisms (pollinators, mutual-

ists, symbionts, but also parasites, herbivores, etc.) be preserved along with the associated biota essential for the long-term survival of a species (Braverman 2014). No *ex-situ* approach can take this into account, and so most of them are doomed to fail in the long run. For example, what is the use of an *ex-situ* conservation program for threatened *Nepenthes* (see Cantley *et al.* 2005; Ziemer 2010; McPherson 2022b) if the required genetic diversity for the conservation cultures is partly created by resorting to removals from natural habitats, where this genetic diversity then is lacking?

Furthermore, not a single one of the "*ex-situ* conservation cultures" of *Nepenthes* (e.g., *N. clipeata* clones grown in German, Japanese, or American greenhouses) also breeds the species' pollinators or the symbionts and other organisms associated with this species that could also go extinct when the species goes extinct in the wild. And regarding possible herbivores and parasites specialized to this species (which are also part of and often have essential regulatory functions in the local ecosystems), the *Nepenthes* grower will likely want to get rid of with sprays rather than conserving them.

Ex-situ conservation might allow individual species to endure in cultivation, i.e., part of their gene pool will be "preserved" into the future, but the entire ecosystem and thus the long-term survival of the living organism and its biotic interactions at the natural sites cannot be preserved in this way. For nature conservation and the urgent aim of preserving global biodiversity, we should stop thinking of "preserving" single species (of horticultural interest, or because they are charismatic animals such as the panda bear), but we will have to turn to concepts to preserve and better protect their entire ecosystems.

In general, the success rate for reintroducing plants after *ex-situ* conservation is low (Braverman 2014). Cultivated plants that are replanted at the natural sites of origin after local extinction, or to support declining populations of endangered species, unfortunately often have a very low chance of survival. Seeds of cultivated plants that are replanted at the natural site often germinate poorly or not at all (Maschinski & Haskins 2012). One of the reasons for this is that propagation in cultivation always creates a so-called genetic bottleneck: in cultivation, it is usually not the same individuals that establish and survive from a given seed capsule as they would in the wild.

In cultivation, plants will grow under conditions that are optimal for them (and without competition from other species) in the so-called auto-ecological optimum. However, this is a purely artificial system that is not found anywhere in nature. In cultivation (no matter if seeds are going to be raised in pots or *in vitro*) those individuals (or clones) are automatically and unintentionally selected that grow best under our specific growing conditions—in the wild completely different genotypes might have prevailed. Seedlings that might be slow growing in culture (and therefore will not even be considered for *ex-situ* conservation because they are selected out by the breeder or die anyway), or seeds not germinating under these conditions at all, might have been the best adapted ones under the specific conditions of the natural site.

In consequence, in an *ex-situ* conservation program, the genotypes that grow best in cultivation are not necessarily the same that would grow best in the wild.

Also, the success of a conservation culture strongly depends on the long-term interest and cultivation success of the institutions/persons involved. It can never become a matter of the short-term interest CP grower like: "today I will participate in the *N. clipeata* project... tomorrow I am no longer interested in lowland *Nepenthes*, my focus now is *Sarracenia*". Even "professional", institutional *ex-situ* conservation cultures, e.g., of botanical gardens, which are based on legally taken material from a natural site, regularly fail (see e.g., Peruzzi *et al.* 2004; Peruzzi pers. comm.). This is not meant to be a general plea against *ex-situ* conservation (there are also a few success stories where this worked well, e.g., the conservation of *Aldrovanda* at the species' last remaining site in Japan; Kondo *et al.* 1997), one just has to be realistic. The conservation aspect certainly can never be an argument to justify the illegal removal of species from their natural habitats.

Poaching of CPs has increased in the 21st Century

Unfortunately, poaching of CPs from the wild and their illegal trade is steadily increasing today (Clarke *et al.* 2018; Cross *et al.* 2020; McPherson 2022b; Carnivorous Plant Poachers 2023), mainly on a commercial scale, but also in the removal of individual plants by plant hunters. Poaching tourism—the search for natural sites specifically to dig up plants or to take seeds—has reached alarming numbers (Figs. 6 & 7). Photos of plants at their natural sites are often posted with pinpoint geo-coordinates on social media, photo databases, and platforms such as iNaturalist or ISpotNature, encouraging poaching from the last remaining sites of many rare CPs. Rice (2019) reports *Sarracenia* sites in the US that were poached just days or even hours after photos of them became public online. At least on iNaturalist, all uploaded *Sarracenia* observations are no longer accessible with exact geo-coordinates, the same applies to other CP species classified as endangered, especially some *Nepenthes* and Australian tuberous *Drosera*.

The great pressure by over-collecting and the threat by poaching also lead to the fact that for many of the newly discovered CP species, especially for spectacular species that might be of high horticultural demand, exact localities are no longer provided for conservation reasons in publications and species descriptions. This became necessary for a good deal of new CP species that have been published as new to science in the past decades, e.g., *Drosera buubugujin* (Mathieson & Thompson 2020), *D. atrata*, *D. hortiorum*, *D. koikyennuruff*, *D. macropetala*, *D. reflexa*, *D. rubricalyx* (Krueger *et al.* 2023), *Nepenthes berbulu* (Tan *et al.* 2023), *N. flava* (Wistuba *et al.* 2007), *N. holdenii* (Mey *et al.* 2008), *N. pudica* (Dančák *et al.* 2022), *N. undulatifolia* (Lee *et al.* 2011), and others (essentially, most new *Nepenthes* species described recently). All these species descriptions explicitly state that exact localities were withheld for conservation purposes to avoid exploitation of the sites for the horticultural demand. This translates into: if it would become publicly aware where these species grow, they would be poached by plant hunters and CP growers until nothing was left. Many people who have studied CPs in the wild (including myself) no longer provide any locality data to anyone. Obviously, long-term survival for some rare CPs on this planet today is only possible if no one knew exactly where they grow.

Even the attempt to make spectacular new species legally available to CP breeders with seeds taken legally by official collecting permits and thus to take the collecting pressure off the natural populations fails because of the "want to have" of some CP collectors. For example, in case of the microendemic, endangered *Drosera magnifica*, a few seeds were taken by the discoverers with collecting permits and distributed worldwide to experienced growers for propagation (also *in vitro*) and to share among CP collectors. As a result, the species was available to CP collectors shortly after its discovery. And yet, when we visited the natural site of this species in 2018, we were told by local conservationists that a "group of plant enthusiasts from Asia" had been on the mountain shortly before and had dug up some adult plants there.

Some CP collectors apparently care little about applicable laws, and these individuals apparently also do not care whether their actions cause long-term and irreparable harm to wild populations and thus to the survival of the plants they admire, or perhaps just want to own. Clarke *et al.* (2018) wrote that some CP collectors consider it their right to help themselves to wild populations at the natural site as a matter of course for their hobby, and that they consider this "right" to be more important than the right of these plants to exist undisturbed at their natural sites. Nature as a self-service store for the hobby of a few?

This doesn't have to be necessary at all. Pretty much all CP species that can be grown in cultivation are available for little money as well-established plants from registered, legal dealers (and there

Figure 6: Remains after poaching of a local population of *Cephalotus follicularis* in Western Australia. About 40 stocks and large mature individuals of this endangered species were still growing at this particular site, 30 of which were excavated in 2019 by an unknown perpetrator. This local population is now likely to become extinct solely due to the demand for *Cephalotus* location forms for cultivation by CP growers! Photos: Brian Quinn.

Figure 7: Poaching holes as leftovers of illegal excavation of tuberous *Drosera* (at this site: *Drosera stricticaulis*) in a National Park near Perth, Western Australia in 2019. Photos: Thilo Krueger.

are more and more on offer every year). The chances of survival of such plants are much higher than those of wild collected specimens, and you will get healthy, vigorous plants. What more could you want? Obviously, however, some people are not at all interested in enjoying healthy, beautifully grown plants in cultivation – they want to collect "location forms", "wild clones", or plants that are "seed grown". Without additional locality data, these plants seem to be worth nothing at all to these individuals (Meyers-Rice 1996, 2001). That is collecting of plants as a stamp collection. However, 20 new "location forms" of *Cephalotus follicularis* in cultivation also mean at least 20 times illegal wild removals of this strictly protected plant species, which is endangered in the wild. In such cases, the term "*Cephalotus* fans" only makes sense if you see fan as an abbreviation of fanatic, who apparently cares about the survival of this plant only in their own collection, but care quite little about the species' survival in the wild.

Why this increased interest in "wild origin material" in our hobby lately? To see who can buy the most beautiful poached *Nepenthes edwardsiana*? Surely that's not an accomplishment. Anyway, I pay my respect to anyone who manages to grow a *Nepenthes edwardsiana* (or any other CP species) from *in vitro* propagation obtained from a legal source (registered CP nursery) into a large, beautiful, flowering plant. That's how the grower proves their horticultural skills. For the owners of plants plundered at the natural locations, however, there is just contempt, and hopefully at least in some cases a complaint because of offence against international species protection laws. This also seems to be the only way to legally stop the illegal trade with wild collected plants: by prosecuting the buyers. Of course, local people involved in conservation have also tried to report the illegal suppliers/traders/sellers of wildlife (e.g., in the case of *Nepenthes* poaching at Mt. Kinabalu, to the relevant National Park authorities in Sabah). However, unfortunately, the prosecutions in the countries of origin usually come to nothing. In the case of other protected animal and plant species that are highly endangered by international illegal wildlife trade (e.g., cacti, many reptiles), it has proven to be quite effective to take action against the buyers, who are mostly located in countries with more effective law enforcement of biodiversity and customs crimes. It is hoped that this will also be effective in the case of CPs.

Among the above-mentioned "hobbyist groups" of plants, the phenomenon that cultivated species are also naturalized, i.e., deliberately planted, at foreign natural sites, to my knowledge exists only in the case of CPs and orchids. This refers to the deliberate introduction, i.e., by sowing or planting, of alien plant species by humans for the supposed "enrichment" of the local flora. In most countries, such introductions to the wild are regulated by Nature Conservation Acts and any release of alien or native organisms are subject to approval by the respective local, federal, or national Nature Conservation Authority. Such are generally prohibited in nature reserves or other protected area (which include most CP habitats such as bogs and swamps in the Northern Hemisphere). From a nature conservation point of view, alien species introductions are just as problematic (and furthermore likewise illegal) as the poaching of species from their natural habitat. Invasive non-native species can have severe negative impacts on locally native species and are considered one of the major threats to global biodiversity (Pyšek *et al.* 2020). It is actually sad to have to report about this in the newsletter of a society like the ICPS that unites people who are passionate about CPs for various reasons, that the illegal activities of a few from this worldwide CP community are responsible for the threat to and the disappearance of some of our beloved CPs in the natural habitats.

The introductions of foreign plants to native CP habitats are not a "trivial offense", but an administrative offense according to most countries' Nature Conservation Acts, which can be prosecuted with high fines (in Germany, release of non-native species like *Sarracenia* into protected habitats such as bogs can be prosecuted with a fine of up to 10,000 Euro, see German Federal Nature Conservation Act §69). Under this category fall both the removal of protected species or their parts, including seeds, as well as the release of plants in protected areas, as well as any introduction of alien CPs in bogs or other natural CP sites. Conservationists and the people who are responsible for the care of the remaining native CP sites usually file a complaint with the responsible authorities if there are signs of poaching and illegal wild removals as well as species introductions in protected areas. I hope, this has already enough deterrent effect for some which had the thoughts: "there are so many plants of that one species out there, surely it won't harm if I took a few..." or: "that bog over there, now that looks like a good CP habitat, let's drop a few seeds there...".

Apart from the illegality aspect, the conservation status of the local CP habitat is done a disservice by the actions of plant introducers. In the worst case, a nature reserve or other protected area overgrown with invasive neophytes (and some alien CPs have proven to be invasive weeds!) can lose its protection status (and would then no longer be protected from possible agricultural or construction measures, for example). Technically, a raised bog in Europe overgrown with North American *Sarracenia* is no longer considered untouched nature worthy of legal protection. It becomes a "developed" area planted with alien plants. Such alien flora must then be painstakingly removed by the responsible nature conservation authorities, which are concerned with the preservation of these unique and last remaining species-rich natural habitats. Anyone who has ever taken part in a maintenance measure in a raised bog knows what an effort this means.

At the same time, criminal charges can be filed against the unknown introducers of these plants with the respective nature conservation authorities. Nevertheless, there are obviously still enough people among the CP enthusiasts who think that any native bog habitat would only become more interesting with the addition of some *Sarracenia*, *Darlingtonia*, *Dionaea*, or *Aldrovanda*, or that the species inventory of the naturally occurring native *Drosera* and *Utricularia* species needed to be "enriched" by further, exotic species. There are many examples of such species introductions from almost all countries with an active CP grower community.

Figure 8: Examples of deliberately introduced CPs as invasive species: *Drosera capensis* forms mass populations at Albion Bog, California, USA, threatening the unique ecosystem of Pygmy Forest. The locally native *D. rotundifolia* does not stand a chance against the vigorous superiority of the weedy *D. capensis* that occupies its habitat.

In addition to the bastardization of the flora aspect, some CP species do have the potential to emerge as invasive neophytes, e.g., weedy species such *Drosera capensis*, *D. tokaiensis*, *D. spatulata*, *D. aliciae*, *D. filiformis*, *Utricularia subulata*, and *U. bisquamata*. All of these species, among many other cultivated CPs, have been released into the unique and threatened habitat of the Pygmy Forest in the Albion Bog in California (Rice 2008; Cross *et al*. 2020; Fleischmann 2021). There these CP species, especially *D. capensis*, are now developing mass stands that are impossible to be removed (Fig. 8). The locally native *Drosera rotundifolia* has now been pushed back to a few patches by the much more vigorous introduced species (pers. obs.). Unfortunately, with ongoing global warming, more and more invasive exotic weeds are capable to establish and naturalize in areas where they were not able to survive previously (Hobbs 2000; Nobis *et al*. 2009). Among these climate change winners are also some weedy CPs, e.g., *Utricularia gibba*, which was not hardy in many European climates, but which was recently found to survive and become an invasive species at very high risk in some countries due to global warming (Piria *et al*. 2022).

The following examples of introduction and naturalization of CPs in intact, protected natural sites shall be listed concretely as acts of natural offences, all of them committed by thoughtless CP "lovers"! Please do not take them as a template for imitation. In some cases, the released CPs still could be removed more or less successfully, in none of the cases an "enrichment" of the native flora or the biotope by the released CPs was assumed.

In the US, alien CPs, in particular *Drosera*, *Sarracenia*, and *Dionaea*, have been introduced to a number of bog habitats outside and within their range. The infamous example of Albion Bog has been mentioned above already – in this pristine bog habitat, numerous CPs have been illegally introduced, including *Heliamphora*, various *Sarracenia* species and cultivars (Fig. 9), *Darlingtonia*, and even tuberous *Drosera* such as *D. gunniana* (pers. obs. 2018). In the protected Butterfly Valley, *Drosera* × *hybrida* has been recently introduced by CP enthusiasts (Brittnacher 2012). *Aldrovanda* has been released in 1999 into a pond in Orange County, New York by CP growers where it naturalized, spread into other water bodies, e.g., Lake Owassa, New Jersey, where today it forms populations of millions of plants (Lamont *et al*. 2013).

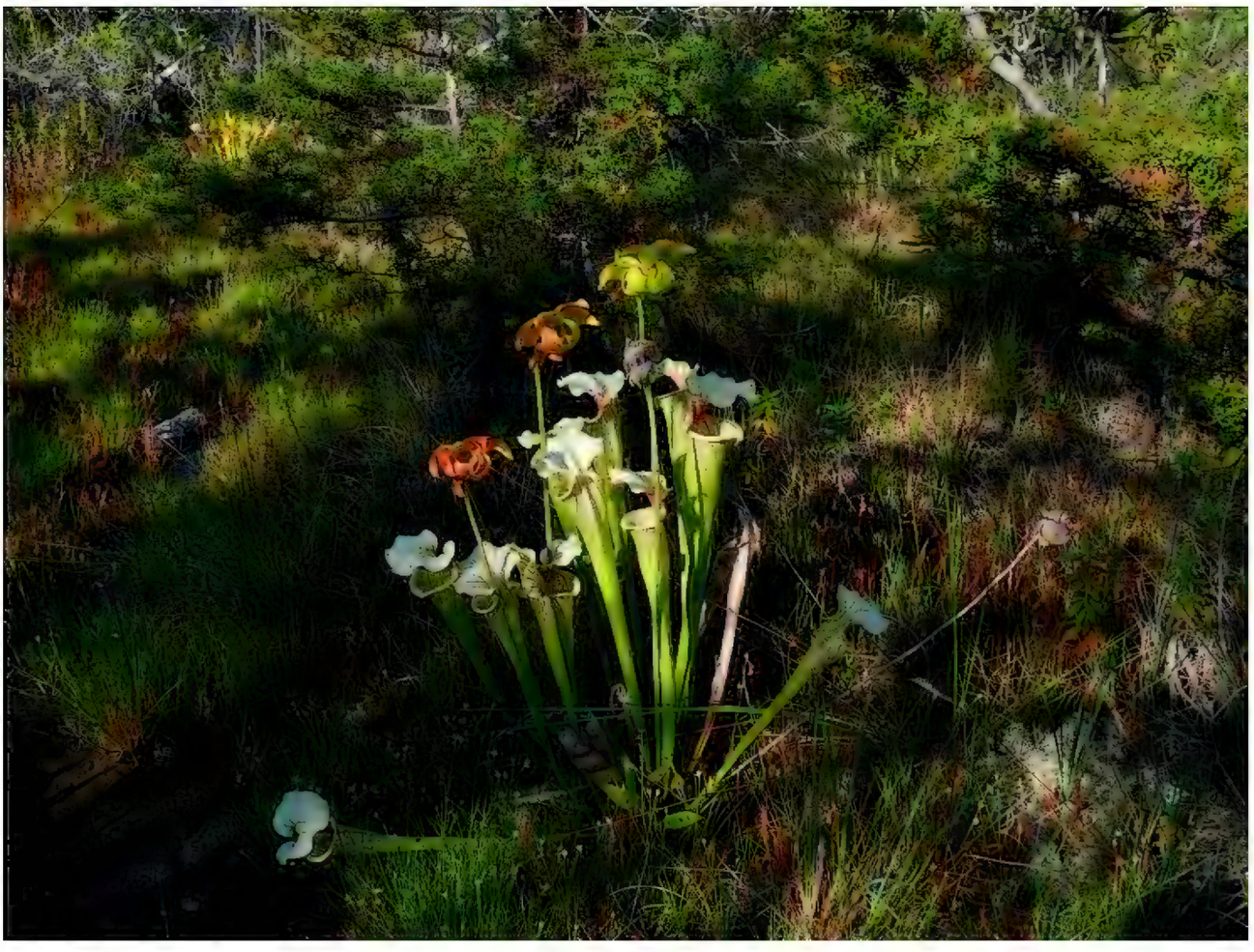


Figure 9: A wide variety of commonly cultivated CPs have been and apparently still are introduced into Albion Bog and the entire habitat is now occupied by invasive non-native CP. Sadly, this is also increasingly the case in other bogs and protected areas worldwide. This involves plantings of *Sarracenia* and other CPs (*Sarracenia* 'Adrian Slack' pictured here from Albion Bog in 2018, as well as the everywhere present *Drosera capensis*). Introducing non-native species is not a "peccadillo", but a legal offence. To make it clear: this picture was not taken in a private bog garden, but in an area protected by The Nature Conservancy. The last remaining natural sites should not become an "experimental garden" for a few individuals, which produces a bad reputation for the CP community.

Sarracenia purpurea subsp. *purpurea* has been deliberately introduced into intact peatlands at more than 100 sites in Europe, including the UK, Ireland, Sweden, Denmark, France, Germany, Austria, Switzerland, and the Czech Republic, and also to a few sites in Japan and New Zealand (Parisod *et al*. 2005; Adlassnig *et al*. 2010; Walker 2014). At many of these sites especially in England and Ireland, it has become an invasive species, self-reproducing and spreading by seeds (Parisod *et al*. 2005; Adlassnig *et al*. 2010; Walker 2014; pers. obs.), and with a repeatedly documented negative impact on the abundance and composition of native bog flora, including native CPs such as *Drosera rotundifolia* (Trippi 2006; Adlassnig *et al*. 2010; Walker 2014; Walker *et al*. 2016). Therefore, *S. purpurea* has recently been added to the blacklist of invasive species in a few European countries such as the UK, Switzerland, and Germany (Nehring *et al*. 2013; Walker *et al*. 2016) which includes the direction for its removal from bogs where it had been naturalized (Parisod *et al*. 2005; Walker *et al*. 2016; Chatters 2020). This species in particular has an additional negative effect on the biodiversity of raised bogs in Europe, as the non-native *Sarracenia purpurea* quite effectively captures locally native insects, including rare species and essential pollinators of other

Figure 10: *Sarraceniopus* mites observed in 2018 from the interior of a dissected pitcher of naturalized *Darlingtonia* at Albion Bog, California, USA.

plants (Sanderson 2012; Franklin *et al*. 2017; Chatters 2020). This species also captures juveniles of amphibians and reptiles as prey to a significant extent, at least at some sites in its natural habitat (Moldowan *et al*. 2019; pers. obs.) but also in Europe (pers. obs.). In some European raised bogs, their pitchers sometimes can be filled with juveniles of the protected Viviparous Lizard (*Zootoca vivipara*) (pers. obs. and communication from nature conservation wardens in the Bavarian Forest). Additionally, North American *Sarracenia* infauna, such as the pitcher inhabiting mite *Sarraceniopus*, has been unintentionally introduced to European bogs as non-native animals together with planted *Sarracenia purpurea* (Goddard *et al*. 2022). By the presence of this obligate *Sarracenia* inhabitant in Europe one can even safely conclude that wild-collected, living pitcher plant stocks once had been planted in a given bog. *Sarraceniopus* mites have also been observed by the author of the present article in all *Sarracenia* and *Darlingtonia* pitchers in Albion Bog (Fig. 10), i.e., outside their native USA range. The effect on the established ecosystems caused by these additive alien species which will unnoticedly but inevitably come with such plantings, along with other organisms such as soil microbes including fungi, bacteria and other putative pathogens, cannot be foreseen.

Other hardy, non-native, mostly North American CP species have been introduced to various bog habitats in Europe, including *Sarracenia oreophila*, *Dionaea*, *Darlingtonia*, and *Utricularia* (Fleischmann 2016). In Switzerland, France, and the Czech Republic, *Pinguicula hirtiflora* has been introduced at some of the sensitive limestone dripping wall habitats and seepages, where this species reproduces well and, at one site in France, even threatens the naturally occurring, highly endangered *P. reichenbachiana* there by overgrowth (Fleischmann & Roccia 2018; Cross *et al*. 2020).

In the Azores, the South African species *Drosera aliciae* and *D. capensis* have been introduced deliberately from cultivated material and since naturalized at some seepage habitats (Borges *et al*.

2010; Costa *et al*. 2013). In Brazil, plantings of *D. capensis* and *D. binata* into pristine CP habitats have fortunately been detected in time and could be removed completely (P. Gonella, pers. comm.).

Seven alien *Drosera* species have so far been introduced into native CP habitats in Japan by carnivorous plant enthusiasts (*D. aliciae*, *D. binata*, *D. capensis*, *D. capillaris*, *D. filiformis*, *D.* × *hybrida*, *D. intermedia*, *D. pygmaea*), several of which naturalized and threaten local native CP species, and which are removed by local conservationists and volunteers (Kataoka & Nishimoto 2012; Kagawa 2015). Additionally, *Dionaea*, *Sarracenia* spp., aquatic *Utricularia* spp., as well as the SE-USA species *Pinguicula primuliflora* have been deliberately planted to and naturalized in wetland habitats in Japan (Kadono *et al*. 2019; Shimai 2021).

In New Zealand, European *Pinguicula grandiflora* was planted in a nature reserve ("Rogue carnivorous plant-lovers sabotage national park": www.nzflora.info), and in Australia, South African

Utricularia sandersonii was introduced by CP lovers in a protected area in the Blue Mountains (Conn *et al*. 2004). Unfortunately, there are quite a few more such examples, especially from Europe and the USA.

It is precisely the nutrient-poor CP habitats (such as raised bogs and seeps) that are one of the last biotopes that have been largely spared from being spoilt by neophytes and flora adulteration. It is precisely this gap that some CP lovers are now ingloriously and completely unnecessarily trying to fill. It is quite clear that this is due to the ill-considered actions of individual black sheep, but ultimately this falls back on the entire CP community. Personally, I would rather see the global CP community (such as the ICPS) as a player in conservation than as part of the problem. Whether this will remain the case in the public perception due to these negative individual actions is unfortunately impossible to foresee.

Conclusion

I hope that I have succeeded at least a little bit in pointing out the negative correlations regarding CP growing and conservation with this article, some of which may not have been clear to some at first, and perhaps to move one or the other to critically reconsider their attitude and actions with regard to wild origins and species introductions. Many of our beloved CP species are critically endangered or even threatened with extinction in the wild. Their future survival depends not only on global politics and economics, but for many species often very specifically on our very own behavior and attitudes regarding our hobby. We should act in a way that future generations will still be able to enjoy these species in intact natural habitats. Endangered CP species are best kept in their natural habitats. It is of course okay for the CP enthusiast to grow *S. oreophila* and other endangered CP species, if obtained from a trustworthy, legal source and as long as location information is not the reason for collecting plants.

Acknowledgments: For information on illegal "poaching rings" and the illegal trade with wild collected CPs, especially of *Nepenthes*, but also *Sarracenia*, *Drosera*, and *Cephalotus*, for tips and reports on threat scenarios for CPs at the natural sites, on conservation law, and for providing photos for this article, I would like to thank Lubomír Adamec, Greg Bourke, Charles Clarke, Adam Cross, Christian Dietz, Michal Golos, Paulo Gonella, Thomas Gronemeyer, Klaus Keller, Thilo Krueger, Chien Lee, Drew Martinez, Stewart McPherson, François Mey, Brian Quinn, Barry Rice, Alastair Robinson, Maurizio Saroldi , André Scatigna, and Willy Zahlheimer. John Brittnacher, Barry Rice, and Bob Ziemer made helpful comments to the manuscript. Finally, I would especially like to thank all the unknown CP growers who care about nature conservation and do not buy wild-collected plants and seeds.

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Education Corner: Carnivores in the Classroom update

https://doi.org/10.55360/cpn522.kc101

Kenny Coogan • ICPS Education Director & Community Relations • kenny@carnivorousplants.org

For the second year in a row the ICPS was proud to announce 24 $150 grants for K-12 teachers in public and private schools. These funds allowed teachers to add live carnivorous plants, as well as R/O systems, tanks, pots, substrate, lighting, and literature to classrooms around the world. These grants are funded by you, the members, in the form of donations. If you want to help us spread the joy of carnivorous plants and fund even more classrooms next year visit https://www.carnivorousplants.org/donate.

The application window is open yearly from August 1 - 31. Applicants were notified by mid-September. After five months after receiving the grant, the awardees agreed to provide a description and photos highlighting how they used the grant. Here are some abridged samples:

When we received the grant for the carnivorous plants, I had the students in my life science class apply to be a part of an after-school club. They called themselves the Killer Plant Club based on the name of the store where we purchased the plants. The students spent the next month researching the various type of plants available. They then created a slideshow with information about each of the plants and questions to ask regarding care of the plants.

In November we went on a field trip to the Killer Plant Company where they learned more about the plants, asked questions, and picked out 10 plants for our classroom.

I teach sixth, seventh, and eight grade science and all of the students have shown interest in the plants. They often stop by to look at them on the way to their seats. I have the name of the club members on the terrarium so that students can "ask the experts" which they do. I have not taught any lessons using the plants yet, but our unit on plants is coming up soon and I will use the plants to talk about their parts and how they reproduce. Thank you so much for your program. The plants are a big draw for the kids and also for prospective families touring our school.

Pamela A. Clark

When I applied for the grant, I had a few doubts in the back of my mind concerning the direct relationship between carnivorous plants and what I taught (physics and meteorology). After receiving the grant that added to my collection and doing the formal lesson, however, it is obvious to me that the largest benefit of this grant is the conversations and interest that having carnivorous plants in the classroom catalyzes.

To illustrate this: first, consider the lesson I did with my physics students one afternoon. As you can see in the attached pictures, *Pinguicula* 'Aphrodite' can look quite different, even amongst the same exact clones. I presented this puzzle to my students, gave them some general pathways (lighting, soil, water, nutrients, temperatures, etc.) and had them get to work seeking out an explanation for this difference in appearance. I had them all download a PAR/Lux meter onto their phone and gave them some other metrics to consider. As they went around my room to investigate/measure, you could see the engagement that was happening. Ultimately, this lesson ended with great conversations about lighting, placement, and care of carnivorous plants and the effects each of these potentially has on leaf color and size.

Next, consider all the interest and conversation this has generated. For example, I am known as "the teacher with the carnivorous plants" at my high school. Random students whom I did not know have asked to come into my classroom and look around. One of the counselors is amazed, and one of the Assistant Principals is setting up a terrarium for his office, in part motivated by my "experimental" classroom.

The amount of interest this experience has generated for science, and specifically, carnivorous plants, is disproportionate (in a good way) to the amount of money received by the grant. This has been a great investment - thank you so much for this opportunity!

Dave Long

My class was thrilled to receive the grant that allowed us to bring carnivorous plants into our classroom. I teach 7th grade life science and earth science. We have used the carnivorous plants in our classrooms as a recurring phenomenon for my students to explore. They were first introduced to the plants with our nature journaling activity. In this activity, the students had to draw the plants from three different perspectives; an above view, side view, and from sitting on the floor. After they drew their pictures, the students had to come up with a list of questions they had about the plants. They came up with some amazing questions which really sparked their curiosity. The students were able to answer some of those questions by making carnivorous plant books where they got to research and create informational booklets.

We also used the carnivorous plants as a way for students to get excited about what characterizes something as being alive. The students were able to witness plants reacting to stimuli by feeding them mealworms and flies! Being able to see the plants respond to stimulation really allowed my middle schoolers to grasp the concepts of characteristics of life. I am looking forward to bringing the plants back into focus when we talk about plant anatomy, adaptation, and evolution.

Thank you for choosing our classroom for this grant! It has brought such joy to our classroom. We got to witness our fly trap flowering!

Stephanie Kerr

I teach 8th grade science at a middle school where the majority of the students are on free and reduced lunches. They live in-town in a small city, and many have never been out of our state. They know about Venus flytraps, but they are not familiar with other types of carnivorous plants.

We are starting our unit on the Diversity of Life today, and the students will be comparing and contrasting humans to our carnivorous plants. I want them to realize that they have more in common with the plants than they would first think. We will be writing and then sharing some of our ideas with each other. When I introduce dichotomous keys, I will be leading them through an activity that includes a carnivorous plant dichotomous key. Students will first sort 12 carnivorous plants that I have pictures of, and then they will later identify each one to its genus and species names.

Jill Nagy

I teach both AP Environmental Science (APES) and AP Physics. I was very lucky to be selected for a grant from the International Carnivorous Plant Society this year and would love to share how these wonderful plants have enhanced my classroom. I wrote the grant with the intention of using them specifically in my APES class, but they've become a school sensation! I often have other staff and students come in to check on what's become colloquially known as the "chompy plant buddies."

I was originally planning on purchasing a terrarium, but in the end, I decided against that since we ended up with so many different species. I was able to purchase lights, and quite a variety of species. I was given a generous discount from Gem State Carnivores in Boise, Idaho (and road tripped to pick them up!) so I have fourteen different plants in total, ranging from *Nepenthes*, *Drosera*, *Pinguicula*, *Sarracenia*, *Cephalotus*, and even a few *Dionaea*. The students decided they wanted a variety, and I was able to purchase enough that each student will have a plant to take home at the end of the school year.

I incorporated these plants into our ecology unit – each student "adopted" a plant and learned it's classification, habitat, common prey, life expectancy, natural predators, and human impacts of each plant. Students presented their information to the rest of the class so that everyone gained knowledge about each plant. They're completely responsible for care – watering, feeding, light requirements, and soil requirements. Plants were taken home over winter break, and I'm thrilled that they all came back alive. We learned about dormancy patterns with the *Sarracenia* and *Dionaea* because they wanted to experiment with some skipping dormancy and some going into dormancy. They also have completed water and soil testing regularly to ensure optimal growth. In the way of teenagers, they've named each "chompy buddy" and decorated with rock and ceramic frogs. It's been an absolutely wonderful project throughout the year, and I'd love to make it a part of each year's learning!

Thank you so much for this opportunity – it's been incredible for myself and my students. I am now a lifelong *Nepenthes* fan, my kids have seen first-hand how a fly looks after deteriorating in a pitcher, and they will never forget what they've learned. You've made my first year teaching AP Environmental Science a joy!

Jessica Donnelly

As of January 2023, the carnivorous plants I purchased through this grant have been used for observation and background research. We will be doing experiments with the plants in the spring when the *Sarracenia* are no longer dormant. Students have done exploration about carnivorous plants in general and specifically on the varieties I have in my room. After some lessons about the classification, structure, and adaptations of the plant kingdom, students will have two major assignments related to the carnivorous plants: 1. "Design a carnivorous plant"—students will create their own version of a carnivorous plant, imagining other ways that plants could attract, trap, and digest insects; 2. Experimenting with the plants—we will use student-designed experiments to study the

plants. The students have already suggested ideas for experiments with the plants. Later, we will evaluate the ideas and refine the experiments that we will conduct in class. Already, the students have come up with quite a few questions that could be investigated. My students have been inspired to develop a wide variety of questions about our plants! Overall, this grant has been quite a boon to my students.

Eric Rude

Do you remember that teacher that went above and beyond? Do you remember that defining moment when you first realized that plants could capture, trap, and digest prey? If you want to help us spread the thrill of carnivorous plants and fund even more classrooms next year visit

https://www.carnivorousplants.org/donate

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We have partnered with creator-spring.com to offer carnivorous plant merchandise to all our members. On our shop you can choose many different items including mugs, t-shirts, sweatshirts, notebooks and more! Proceeds go to our education and conservation initiatives. Visit

https://world-carnivorous-plant-day.creator-spring.com/

to place your order. Orders are shipped internationally.

Keywords: cultivar, *Dionaea* 'Angioma', *Dionaea* 'EEC Thresher Shark', *Pinguicula* 'Urchin', *Pinguicula* 'Damon's Choice', *Sarracenia* 'Camisole', *Sarracenia* 'GraceY', *Sarracenia* 'Spanish Dancer', *Sarracenia* 'Yellow Hornet', *Sarracenia* 'White Cobra', *Sarracenia* 'Wilkerson White Knight', *Sarracenia* 'Flamenco', *Sarracenia* 'Asmoderolle', *Utricularia* 'Garcia's Treasure'.
https://doi.org/10.55360/cpn522.cv522

Abstract: Thirteen new carnivorous plant cultivars are named and described: *Dionaea* "Angioma', *Dionaea* 'EEC Thresher Shark', *Pinguicula* 'Urchin', *Pinguicula* 'Damon's Choice', *Sarracenia* 'Camisole', *Sarracenia* 'GraceY', *Sarracenia* 'Spanish Dancer', *Sarracenia* 'Yellow Hornet', *Sarracenia* 'White Cobra', *Sarracenia* 'Wilkerson White Knight', *Sarracenia* 'Flamenco', *Sarracenia* 'Asmoderolle', *Utricularia* 'Garcia's Treasure'.

Dionaea 'Angioma'

Submitted: 6 March 2022

Dionaea 'Angioma' (Fig. 1) comes from a 2016 red dentate *Dionaea* seedling. It produces a lot of beautiful dark red traps with some green discolorations. This plant is similar to a red dentate cultivar, but the traps have discolored patches that appear during summer. The size, shape, intensity, and frequency of patches are quite random. However, on adult plants, there are always nice green patches on traps.

The etymology of this name comes from angioma or hemangioma; a vascular tumor composed of small blood vessels lined by endothelial cells. In fact, this plant produces a lot of beautiful red traps with some green discolorations.

—Julien Müller • Saint Germain de Joux • France • julienmullerain@gmail.com

Figure 1: *Dionaea* 'Angioma'.

Dionaea 'EEC Thresher Shark'

Submitted: 24 November 2022

Dionaea 'EEC Thresher Shark' (Fig. 2) is the product of a collaboration between Evan Wang and Emmy Wang. Hand pollination was performed in Palo Alto, California in July 2018 by Evan and Emmy Wang with isolation of flowers after pollination. The seed was the product of the following cross: *D.* 'WIP Slim Snapper' × *D.* 'Red Piranha'. Numerous seeds from this cross were grown by both Evan and Emmy Wang. Of the over 45 seeds, only one developed the unique phenotype of *D.* 'EEC Thresher Shark'. *Dionaea* 'EEC Thresher Shark' is characterized by complex serrated cilia with primary dentate points separated by serrated secondary points. The cilia are similar to *D.* 'FFT Stegosaurus', but the primary points are broader. The traps have a unique coloring. On the exterior of the trap, there is a prominent red line similar to *D.* 'Dracula'; however, as the trap matures, the external trap will fill in with maroon from the red line to the midrib. The interior of the trap is deep red with a lime green edge. Trigger hairs are standard three per trap side. Traps are fully functional and large, measuring up to 4 cm in length. Petioles are very long, measuring up to 13 cm with an upright growth pattern.

The name 'Thresher Shark' is a dual reference to the cilia which resemble serrated shark teeth and the extremely long petiole resembles the extended long tail of the thresher shark. 'EEC' is an acronym for Ev & Em Carnivorium where hand pollination, seed germination, and growing of this cultivar were performed.

Dionaea 'EEC Thresher Shark' can only be propagated vegetatively by rhizome or leaf/floral cuttings to preserve the unique characteristics of the cultivar.

—Evan Wang and Emmy Wang • Ev & Em Carnivorium • Palo Alto • California • USA • stephen_wang2000@yahoo.com

Figure 2: *Dionaea* 'EEC Thresher Shark'.

Pinguicula 'Urchin'

Submitted: 13 December 2022

Pinguicula 'Urchin' (Fig. 3) is a complex hybrid chosen from a pod of seeds germinated in 2018. This pod had multiple pollen contributors so the parentage is officially "unknown" but very likely *P.* [(*hemiepiphytica* × *rotundiflora*) × *cyclosecta*] × *P. esseriana*. The form of this plant is unique: It maintains a very uniform, nearly perfectly round shape with a diameter of approx. 5.5 cm with a precise "Fibonacci spiral" distribution of its leaves. The leaves are 2 cm long × 1.5 cm wide at their largest and are bright green to yellowish-green, edged with purple. The leaves are carnivorous but do not change and are rather like ½ carnivorous and ½ succulent combination. The continuous spiral layering of the leaves on top of themselves creates significant height making the overall form a 3-dimensional half-sphere. All propagules from leaf pulls immediately develop in this same manner and are very slow to grow and mature. The plant form brings to my mind a sea urchin hence the name "Urchin". The flower of *Pinguicula* 'Urchin' is quite beautiful with bright reddish- purple coloring, with a length of 3.2 cm × width of 2.5 cm. The 5 petals all have an angular boxy shape with the lower center petal being significantly longer than the other lateral four petals. The spur is quite long at 4 cm, and the flower stalk is consistently around 15 cm long. The flower does produce pollen, but it is not yet known if it will produce seed.

—Mark Rubnitz • San Francisco • California • USA • rubyjewby@mac.com

Figure 3: *Pinguicula* 'Urchin'.

Pinguicula 'Damon's Choice'

Submitted: 20 January 2023

Pinguicula 'Damon's Choice' (Fig. 4) is a complex hybrid chosen from a pod of seeds germinated in 2016. This parentage of this plant is *P.* (*hemiepiphytica* × *rotundiflora*) × *P. emarginata*. The plant is small at 3.5-5 cm diameter. The individual leaves 2-2.5 cm long by 1-1.5 cm wide and are very similar in form to those of *P. emarginata*, having curled-up, rounded margins. The coloration on the leaves is quite pretty; the new leaves emerge with a bright watermelon-red coloring which lightens to almost beige on the middle of the leaf as the leaf grows out. The margin stays red however and even darkens with leaf maturity. The plant does exhibit carnivorous and non-carnivorous periods with corresponding leaf types. The flower is quite large relative to the plant, sometimes matching the diameter of the leaf spread. The flower is a bright lavender-pink with a slightly darker veining pattern similar to that of a *P. emarginata* flower. It has a nearly round front silhouette with a diameter in the range of 3.5-4.5 cm. *Pinguicula* 'Damon's Choice' can be easily propagated from leaf pullings, but the flower is sterile. When I first noticed this plant years ago, I immediately took a few leaf pulls from which I produced just a few plants, one or two of which I gave to Damon Collingsworth at California Carnivores. I subsequently experienced a substantial die-off throughout my *Pinguicula* collection due to a bad water filter and this plant was among the losses. I was sad and disappointed to have lost it, BUT…a few years later, on one of my many stop-in visits to California Carnivores, Damon pulled me over to his *Pinguicula* table and a 10-inch pot full of small beige plants with large pink flowers and said "Remember this little guy? I LOVE this one, and we've sold a bunch. You need to name it and register it as a cultivar." He also gave one back to me.

So, I proudly introduce: *Pinguicula* 'Damon's Choice'

—Mark Rubnitz • San Francisco • California • USA • rubyjewby@mac.com

Figure 4: *Pinguicula* 'Damon's Choice'.

Sarracenia 'GraceY'

Submitted: 2 February 2023

Sarracenia 'GraceY' was obtained from a cross I made in 2018 between (*Sarracenia areolata* × *Sarracenia* 'Leah Wilkerson') × *Sarracenia* 'Adrian Slack'. At first, I was disappointed in this cross, but my friend told me to keep them and wait. In early summer of 2021, I stepped in my warmhouse and this beauty caught my eyes. I was shocked and couldn't even move my sight away from it.

Sarracenia 'GraceY' impressed me deeply with a sharp contrast between a deep dark purple throat and a white long lid (Fig. 5). The purple of throat sometimes splashes on the lid and body. Spring pitchers get a base colour of green, with some white spots on it. Autumn pitchers have a potential to emerge the same special body colour with *Sarracenia* 'Legacy' and the lid will turn almost full white and be much longer and wavier. Pitcher height usually averages around 60-70 cm. Flower colour is red. In my conditions, the plant grows quite fast, but seldom divides.

The 'Grace' part of name means the plant is a precious gift from the nature, and the letter 'Y' means clone Y1 of this cross.

To maintain these characteristics, propagation must be done only by division.

—Arlen·Weng • Jiangsu • China • melodyshark@163.com

Figure 5: *Sarracenia* 'GraceY' spring pitchers (left), autumn pitchers (center), lid (right).

Sarracenia 'Spanish Dancer'

Submitted: 9 January 2023

Sarracenia 'Spanish Dancer' (Fig. 6) is a plant obtained in Houten, Holland in 2019, bought from a local dealer and selected by me precisely for its characteristics. I bought it as *Sarracenia purpurea* subsp. *venosa*, but seeing the shape and color, I assume that it is a cross between *Sarracenia purpurea* subsp. *venosa* × *S. purpurea* subsp. *purpurea*.

It differs greatly from other *Sarracenia purpurea* primarily for the particular shape of the operculum (a characteristic that has proved to be stable over the years) and for the globularity of the pitchers. The flower is purplish-red like other *Sarracenia purpurea*. It is quite slow in dividing but very hardy.

To maintain and preserve the unique characteristics of this specimen, it must only be propagated vegetatively.

—Emanuele Melani • Agliana 51031 • Italy • emanuele.melani@gmail.com

Figure 6: *Sarracenia* 'Spanish Dancer'.

Sarracenia 'Yellow Hornet'

Submitted: 22 February 2023

Sarracenia 'Yellow Hornet' (Fig. 7) is a hybrid of *Sarracenia* 'Hot Lips' and *Sarracenia* 'Adrian Slack'. I purchased it as a seedling from Phil Faulisi during his July 2019 open house sale.

Predominantly yellow-bodied with highly contrasting red veins, the *S.* 'Adrian Slack' parentage is apparent in the narrow hood column. The characteristic that most distinguishes *S.* 'Yellow Hornet' from *S.* 'Adrian Slack' is the color. *Sarracenia* 'Yellow Hornet' has a strong yellow color throughout the entire pitcher, from tube to lid. There is no white present at all in *S.* 'Yellow Hornet', unlike *S.* 'Adrian Slack' which has a white lid and some white in the upper pitcher. Pitchers are typically 70 cm tall with 10 cm wide hoods. The bright red lips of each pitcher flare outward creating the appearance of substantial width, like a dramatic red waterfall. The lips nearly touch at the back of the mouth, creating a visually appealing shape reminiscent of bird wings. The lid shape undulates like a sine wave and is yellow with red veins on top, and yellow with diffused red venation underneath.

In addition to a very large early season show of robust pitchers, *Sarracenia* 'Yellow Hornet' produces sizable pitchers and some phyllodia in the summer and fall. The flowers are bi-colored like the pitchers, with red petals and a yellow style.

The name Yellow Hornet describes the color as well as the aggressive but slender appearance of the pitchers, like a hornet.

To maintain these unique characteristics, propagation must be done only by vegetative means.

—Lukas Mondoux • Albany • California • USA • bayareacps@gmail.com

Figure 7: *Sarracenia* 'Yellow Hornet'.

Sarracenia 'Camisole'

Submitted: 14 December 2022

Sarracenia 'Camisole' is a select clone resulting from a cross of *S. rubra* subsp. *alabamensis* (seed parent) and *S. leucophylla* (pollen parent). Several decent plants came from this cross but this was the standout plant. Derek Clavel-Bate made the cross in Cornwall, England over 15 years ago.

The tallest pitcher I have recorded so far has been 70 cm. Plant produces a flush of pitchers in the spring and fall with the largest pitchers in the fall due to its *S. leucophylla* genes.

Pitcher color is white with green veining. Peristome is solid white. Lower half of leaves are all green. Pitchers become very frilly along the outer edges. On larger plants, hoods become elongated to an almost triangular shape (Fig. 8). Elongated hoods slowly lower as the pitchers age and end up touching and covering the mouth opening. An interesting feature is on smaller offsets or new growth, pitcher shape and size often look more like a normal alba *S. leucophylla* hood. On larger plants, there are larger elongated, frilly pitchers on older rhizomes and normal-sized pitchers on new offset growth. This results in an interesting look with several pitcher shapes on the same plant.

According to Derek, the plant was named with some amusement with its frilly edges in mind. In England, a camisole is a garment of ladies' underwear. Quite often they are white and almost always have a frilly edge.

Propagation must be done by division in order to maintain this plant's unique characteristics.

—Michael Richard Sprouse • Cooleemee • North Carolina • USA • msprouse@yadtel.net

Figure 8: *Sarracenia* 'Camisole'

Sarracenia 'White Cobra'

Submitted: 11 November 2022

Sarracenia 'White Cobra' (Fig. 9) is a select clone resulting from a cross of *S.* 'Camisole' (seed parent) and *S.* 'Wilkerson White Knight' (pollen parent) that I did in 2016. Plant is rather slow growing but has very distinctive pitchers. The tallest pitcher I have recorded so far has been 92 cm. The plant reached maturity and bloomed for the first time in 2021. Plant produces tall and large pitchers in both the spring and again in the fall but overall largest output of pitchers is produced in the fall due to its *S. leucophylla* genes.

Pitcher color is bright white with light green veining. Peristome is solid white. Throat starts out white and gets a flush of red on both sides that do not touch. The lower two-thirds of the leaves are solid green. Hoods are elongated and may be as large as 13 cm × 16 cm. Newly opened hoods generally remain upright for a couple of days before they flop over to overhang past the front of the nectar roll. The hoods do not touch the nectar roll as with other elongated hood *Sarracenia*. Hoods also become very frilly or wavy after a few days to the point where the two opposite sides may touch. The front of the hoods may be curled or wavy either up or down.

Throat patch does not cover the entire back of the throat as does the pollen parent *S.* 'Wilkerson White Knight'. Pitchers are larger (length and width) and a brighter white than *S.* 'Camisole'. Blooms are red and green.

The plant reminded me of a cobra with the way the pitchers overhang the mouth as well as the two color spots on either side of the throat.

Propagation must be done by division in order to maintain this plant's unique characteristics.

—Michael Richard Sprouse • Cooleemee • North Carolina • USA • msprouse@yadtel.net

Figure 9: *Sarracenia* 'White Cobra'.

Sarracenia 'Wilkerson White Knight'

Submitted: 14 December 2022

Sarracenia 'Wilkerson White Knight' is a natural white *S. moorei* from Bud Wilkerson's Bog in north Walton County, Florida. The plant was discovered by Brooks Garcia and collected with permission. Photo on the left (Fig. 10) is by Brooks Garcia, used with permission.

The tallest pitcher I have recorded so far has been 85 cm. Established plants produces tall and large mouthed pitchers in both the spring and again in the fall, but the overall largest pitchers are produced in the fall due to its *S. leucophylla* genes. Forms thick clumps over time.

Pitcher color is bright white with thin light green veining. Hoods and upper pitchers can infuse with a slight pink or red color depending on conditions. Peristome is a thick solid white with slight green veining. Throat has a red patch at the base of the hood. Red patch on the throat stretches from one side to the other but thickness can vary due to environmental or overcrowding stress. The lower three quarters of the leaves are solid green.

Propagation must be done by division in order to maintain this plant's unique characteristics.

—Michael Richard Sprouse • Cooleemee • North Carolina • USA • msprouse@yadtel.net

Figure 10: *Sarracenia* 'Wilkerson White Knight' (left by Brooks Garcia; right by Michael Sprouse).

Sarracenia 'Flamenco'

Submitted: 4 March 2023

Sarracenia 'Flamenco' (Fig. 11) is from my old collection that goes back to the early 1990s. I grew it from open pollinated seeds I harvested from plants of the Cresco Company in De Kwakel, The Netherlands.

This is a cross of *Sarracenia flava*, *S. purpurea* subsp. *venosa* var. *burkii*, and *S.* × *catesbaei*; and most likely again a backcross with *S. purpurea* subsp. *venosa* var. *burkii*.

The pitchers grow to a height of about 40 cm and stands out because of the enormous hood that resembles the dress of a Spanish flamenco dancer due to the extra ordinary wavy shape of the hood.

The color of the pitchers is green with red veins and a deep-red lip, and as the season progresses the entire pitcher turns more and more red. The red veining of the hood is more pronounced on the inner side rather than the exterior side, and a broad wavy wing decorates the pitcher.

Sarracenia 'Flamenco' must be reproduced only vegetatively to preserve the specific characteristics of this outstanding cultivar.

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Figure 11: *Sarracenia* 'Flamenco' pitcher and flower.

Sarracenia 'Asmoderolle'

Submitted: 18 December 2022

Sarracenia 'Asmoderolle' (Fig. 12) is from a 2014 seedling; the parents being (*S. flava* × *S. purpurea*) × (*S. flava* × *S. leucophylla*). This cultivar grows slowly. Its finely veined green urns are topped by a large, horizontal cap. The colour is pastel white with red veins, which turns pink towards the end of the season, and there is a red spot at the entrance of the urn as in *Sarracenia flava* subsp. *rugelii*.

The name Asmoderolle was invented by my wife.

To maintain the unique characteristics, reproduction must be by vegetative means only

—Mentaz Philippe • 20 chemin de la Bondoise • 59570 Tainières-sur-Hon • France • philippementaz@yahoo.fr

Figure 12: *Sarracenia* 'Asmoderolle'.

Utricularia 'Garcia's Treasure'

Submitted: 2 February 2023

This remarkable natural mutant of *Utricularia longifolia* Gardner differs from other forms of the species by its flowers, which show the lower corolla lip split into three slightly upwards-curving lobes (Fig. 13). The upper corolla lip is somewhat reduced, while the nectar spur appears unaffected. These characteristics give the flowers a distinct and attractive shape which makes *Utricularia* 'Garcia's Treasure' a striking addition to any carnivorous plant collection. The flowers are the same size as those of a typical *U. longifolia*, and their pink color differs from the darker purple flowers of many other *U. longifolia* populations. The modified flowers appear not to produce pollen and consequently cannot self-pollinate. Thus, the cultivar can only be propagated through divisions. The plant has the same cultivation requirements as a typical *U. longifolia* and grows readily, spreading through stolons. As far as we can tell, the vegetative parts look identical to those of a typical form.

Utricularia 'Garcia's Treasure' was discovered by Gabriel Garcia in 2013. It was found growing on *Sphagnum* moss close to the margin of a river in the municipality of Ibicoara, in the state of Bahia, Brazil. The cultivar is named after Gabriel Garcia, who discovered this botanical treasure, and after Bruno Garcia, who has been keeping and propagating it ever since.

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Figure 13: Flowers of *Utricularia* 'Garcia's Treasure' showing the modified corolla (left & center); typical *U. longifolia* flower for comparison (right).